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Original Article

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Prevalence of vitamin D deficiency among diagnosed cases of asthma and its correlation with duration, gender, and socioeconomic aspects

Sara Bano [a], Hafiza Faiza Rauf [b], Shazia Shakoor [c], Aasia Ismail [d], Fahad Usman [e], Sadia Rehman [f]

[a] *Consultant Medical Specialist, Wapda Hospital, Lahore.*
[b] *Senior Registrar, Department of Medicine, Hayat Memorial Hospital, Lahore.*
[c] *Professor of Physiology, Bahria University of Health Sciences, Karachi.*
[d] *Senior Medical Officer, DUA Hyderabad Trauma Centre, Hyderabad.*
[e] *Assistant Professor, Department of Community Medicine, Sialkot Medical College, Sialkot.*
[f] *Assistant Professor, Department of Biochemistry, University of Health Sciences, Karachi.*
Correspondence: dr.sadia89@hotmail.com*

ABSTRACT

BACKGROUND & OBJECTIVE: Vitamin D deficiency has been increasingly implicated in the pathophysiology of asthma, with evidence suggesting its potential role in disease severity, duration, and response to therapy. To determine vitamin D deficiency among diagnosed cases of asthma and its correlation with duration of asthma, gender, and socioeconomic aspects.
METHODOLOGY: This study employed an analytical cross-sectional design. The study was conducted at Imran Idrees Hospital, affiliated with Sialkot Medical College, Sialkot. A sample of 200 asthmatic patients, aged 18 to 60, was included. Patients who were both male and female, and had a clinical diagnosis of asthma verified by spirometry for a minimum of six months, satisfied the inclusion criteria. Patients with asthma-COPD overlap, pregnancy, chronic systemic disorders, or recent vitamin D supplement use (last six months) were excluded. The data were analyzed using SPSS version 23.
RESULTS: Bivariate analysis was done to compare the sociodemographic profile and duration of asthma on vitamin D levels. The proportion of individuals with low vitamin D levels was higher in those who had asthma for more than 30 years. The female gender had a significantly higher proportion of low vitamin D as compared to males.
CONCLUSION: The study revealed that the duration of asthma and gender were significantly associated with vitamin D levels among patients with asthma. Individuals with longer asthma duration and females were found to have low vitamin D levels.
KEYWORDS: Asthma, Vitamin D, Gender, Socioeconomic.

INTRODUCTION

A significant portion of the population is afflicted with asthma, a chronic respiratory disease that affects an estimated 300 million individuals globally across all age groups [1]. With around 250,000 fatalities linked to asthma each year, asthma has significant rates of morbidity and mortality [2]. It is concerning to note that there will likely be an increase in asthma occurrences worldwide by 100 million by 2025. Asthma prevalence in Pakistan is around 20% in children and 6% in the overall population [3,4].

The National Asthma Education and Prevention Programme Expert Panel-3 Report states that asthma is a complex illness with a range of symptoms, including underlying inflammation, bronchial hyperresponsiveness, airflow obstruction, and recurrent episodes of symptoms. Clinically, asthmatic patients have breathing difficulties, chest tightness, episodic wheezing, and a cough that is frequently productive [5]. Due to changes in bronchial tone and reactivity caused by circadian rhythms, these symptoms typically get worse at night or in the early morning [6].

Localized changes linked to asthma include an increase in cellular influx into the bronchi, airway hyperreactivity, ongoing oxidative stress, and imbalances in pro- and anti-inflammatory Th1/Th2 cytokines [7]. Th2 cells cause B cells to produce more IgE by releasing cytokines. Chronic inflammation is caused by a variety of cytokines, which also produce leukotrienes and histamine as mediators. Following this, these mediators cause bronchial hyperresponsiveness, bronchoconstriction, and airway remodeling. A cytokine panel indicative of Th2 cells is expressed by CD4+ T-lymphocytes in asthmatic airways [8].

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An essential fat-soluble vitamin, vitamin D facilitates the intestinal absorption of calcium, magnesium, and phosphate. It is essential for immune system control, preserving lung and cardiovascular function, modulating insulin levels, and promoting skeletal development. Due to changes in lifestyle, vitamin D deficiency is becoming increasingly widespread globally [9]. In both innate and acquired immunity, vitamin D plays a crucial role in preventing the release of mediators from Th1 and Th2 cells, including IL-2 and interferon-alpha [10]. Additionally, it can enhance asthmatics' glucocorticoid response by promoting the development of naïve T cells into T-regulatory cells, which release IL-10 [9,10].

Low vitamin D levels have been linked to an increased risk of asthma and other allergy problems, according to Tomoka et al. Low levels of vitamin D have been linked to poor asthma control, a diminished steroid response, more frequent flare-ups, worse lung function, and a greater hospitalization rate [10]. Moreover, vitamin D supplementation has been shown by studies to be an affordable supportive treatment that can greatly enhance asthma management [11]. A meta-analysis found conflicting and confusing data supporting the use of vitamin D in the treatment of asthma. Nevertheless, although some studies have found a detrimental effect of vitamin D, others have not been able to demonstrate the preventative value of vitamin D supplements in the onset and worsening of asthma [12].

Quantifying vitamin D status specifically in asthmatics remains clinically important because corticosteroid use, reduced outdoor activity, and chronic airway inflammation may deepen deficiency beyond community levels. Establishing the prevalence of this subgroup, therefore, provides locally relevant baseline data for targeted screening, supplementation, and future interventional trials. This study aims to determine the prevalence of vitamin D insufficiency among individuals with asthma in Pakistan. Furthermore, this study may pave the way for future investigations into the potential benefits of vitamin D supplementation, specifically in Pakistani asthmatic patients.

METHODOLOGY

The Imran Idrees Hospital, affiliated with Sialkot Medical College, conducted this cross-sectional study in Sialkot, IRB No. MRC/IRB/23023. The study's time frame was from November 2023 to May 2024. The approach of non-probability sequential sampling. Following the computation of sample size, 200 asthma patients between the ages of 18 and 60 were included in the sample. Patients who were both male and female, and had a clinical diagnosis of asthma verified by spirometry for a minimum of six months, satisfied the inclusion criteria. Patients with asthma-chronic obstructive pulmonary disease overlap syndrome, pregnant women, those with chronic systemic disorders, and people who had used vitamin D supplements within the last six months were all excluded based on predetermined criteria.

The research also excluded participants with long-term conditions that impair vitamin D metabolism, such as chronic liver or kidney illness. After obtaining informed consent, 200 eligible patients were enrolled in the data collection procedure. Each participant provided two milliliters of venous blood, which was then analyzed using an ELISA machine to determine the serum level of 25-OH vitamin D. A survey instrument was used to record pertinent data. SPSS version 23.0 was used to analyze the data. Qualitative variables, such as gender and vitamin D insufficiency, were presented as frequencies and percentages, whereas quantitative data, including age, were reported as mean and standard deviation. The data were further stratified based on age, gender, duration of asthma, and BMI. Chi-square tests were applied to assess the significance. A p-value of less than 0.05 was considered significant.

RESULTS

Table-I: Sociodemographic characteristics of study respondents n=200.

Variables	Categories	n(%)
Gender	Male	162(81.0)
	Females	38(19.0)
Socioeconomic class	Low	89(44.5)
	Middle	87(43.5)
	Upper	24(12.0)
Body mass index	Underweight	33(16.5)
	Normal	107(53.5)
	Overweight/obesity	60(30.0)
Vitamin D level	Low	133(66.5)
	Normal	67(33.5)
Duration of Asthma	Less than 30 years	87(43.5)
	More than 30 years	113(56.5)

Table-II: Bivariate analysis between sociodemographic profile and duration of asthma on vitamin D levels n=200.

Variables	Categories	Low Vitamin D (n=133) n(%)	Normal Vitamin D (n=67) n(%)	P-Value
Duration of asthma	Less than 30 years	51 (58.6)	36 (41.4)	0.038
	More than 30 years	82(72.6)	31 (27.4)	
Socioeconomic Class	Low	59 (66.3)	30 (33.7)	0.998
	Middle	58 (66.7)	29 (33.3)	
	Upper	16 (66.7)	8 (33.3)	
Gender	Male	99 (61.1)	63 (38.9)	0.001
	Females	34 (89.5)	4 (10.5)	
Age of respondents	Less than 40	68 (62.4)	41 (37.6)	0.177
	More than 40	65 (71.4)	26 (28.6)	
Total	-	133(100)	67(100)	-

A sample of 200 patients with asthma were included in the study. The mean age of respondents was 38.91 years with a standard deviation of 11.407. The sociodemographic characteristics of study respondents are shown in Table-I.

Bivariate analysis was done to compare the sociodemographic profile and duration of asthma on vitamin D levels. Vitamin

D levels were significantly different between duration of asthma. The proportion was of low vitamin D was higher in those who had asthma for more than 30 years. Female gender had significantly higher proportion of low vitamin D as compared to males. (Table-II)

DISCUSSION

About 300 million individuals globally suffer from asthma, making it a serious public health concern. In children worldwide, it remains the most common chronic illness. Although deficiency is widespread nationally, this higher proportion in asthmatics underscores their amplified risk, likely driven by disease-specific factors such as inhaled or systemic corticosteroid therapy and activity limitations [13]. Eighty to ninety percent of instances of asthma in people under the age of six had their onset in early infancy [14].

Our study, which included 200 asthma patients as a sample, examined the relationships between sociodemographic characteristics, asthma duration, and serum vitamin D levels. Vitamin D levels and the length of asthma were substantially correlated (p-value = 0.038). Although vitamin D deficiency is endemic nationally, our observed 66.5% deficiency rate in asthmatic patients suggests an even higher burden in this subgroup compared to non-asthmatic populations.

Individuals with asthma for under 30 years (58.6%) and those with asthma for over thirty years had a greater percentage of poor vitamin D levels (72.6%). Vitamin D deficiency is already highly prevalent in Pakistan; large population-based surveys report 53 %–56 % of adults as frankly deficient and a further 20 %–31 % as insufficient. This pronounced shortfall supports integrating routine serum 25-hydroxy-vitamin D screening into adult asthma clinics and initiating supplementation for levels < 50 nmol/L (< 20 ng/mL). Randomized-trial evidence indicates that correcting deficiency can reduce exacerbation frequency and improve lung function in asthmatics, underscoring the clinical value of our prevalence data for context-specific intervention planning [15,16].

The p-value of 0.001 in the study demonstrated a significant correlation between gender and vitamin D levels. This indicates that the vitamin D levels of the male and female subjects differed noticeably. The observed gender disparity in vitamin D levels might be attributed, in part, to hormonal differences between males and females [16,17]. It has been suggested that the hormone oestrogen, which is mostly found in women, influences how vitamin D is metabolised. Oestrogen may have an effect on vitamin D's activation and adherence with vitamin D receptors [18]. These hormonal fluctuations may cause variations in the effectiveness of vitamin D absorption and use. Gender differences in outdoor activities and sun exposure could potentially be significant. Our results are consistent with those of the previous studies [19,20].

In this study, socioeconomic class did not show a notable association with vitamin D levels (p-value = 0.998). Factors such as healthcare access and dietary preferences could be explored further as potential influencers of this relationship.

There was no discernible correlation between the respondents' age and their vitamin D levels. (p-value = 0.177). Both age groups (less than 40 and more than 40) had relatively similar proportions of low vitamin D levels. This study suggests that age may not be a significant predictor of vitamin D sufficiency among patients with asthma. Instead, other factors, such as diet, sun exposure, duration of asthma, and potential unaccounted variables, may be more influential in determining vitamin D levels in both younger and older individuals [21]. The relationship between age and levels of vitamin D in asthma patients may be more clear-cut with larger and more diverse sample sizes, as well as additional variables and interactions taken into account.

While our study has notable strengths, including a large sample size, bivariate analysis, detailed sociodemographic data, and the identification of significant associations, several limitations were also identified, such as the cross-sectional study design, limited generalizability, and potential confounding variables. Future research could benefit from longitudinal studies that track participants over time. This would enable a more in-depth examination of the dynamic relationships between asthma, vitamin D levels, and sociodemographic factors. Investigating the effects of interventions to optimize vitamin D levels in patients with asthma could be a valuable avenue of research. Assessing the impact of vitamin D supplementation or lifestyle modifications on asthma outcomes would be of clinical significance.

The findings of this study offer valuable insights for healthcare providers. Specifically, they highlight the importance of monitoring and addressing vitamin D levels, especially in long-standing asthma cases and among female patients. Optimizing vitamin D status in these subgroups may lead to improved asthma management and potentially better patient outcomes. This study underscores the potential for personalized approaches to asthma care, taking into account sociodemographic factors that influence vitamin D levels and, by extension, asthma severity.

LIMITATIONS

This cross-sectional, single-center study used non-probability sequential sampling, which may introduce selection bias and limit generalizability. The lack of a contemporaneous non-asthmatic control group, single serum vitamin D measurement, and unmeasured confounders (e.g., sunlight exposure, diet, corticosteroid use, season) further constrain causal inference. Socioeconomic data were self-reported, the sample size was restricted, and subgroup precision was compromised. Vitamin D was assayed using one automated platform, whose values may differ from those obtained with reference methods. These factors underscore the need for larger, multicenter, longitudinal studies with random sampling and comprehensive control of confounders.

CONCLUSION

The study revealed that the duration of asthma and gender were significantly associated with vitamin D levels among patients with asthma. Individuals with longer asthma duration and females were found to have low vitamin D levels. However, the study did not find significant associations between vitamin D levels and socioeconomic class or age of respondents. Further research, including longitudinal and interventional studies, is needed to elucidate the underlying mechanisms and to guide interventions aimed at optimizing vitamin D levels in asthma patients.

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REFERENCES:

1. Stern J, Pier J, Litonjua AA. Asthma epidemiology and risk factors. In Seminars in Immunopathology. 2020;42(1):5-15. Doi:10.1007/s00281-020-00785-1
2. Pitchon RR, Alvim CG, de Andrade CR, Facury LM, Cruz ÁA, Dos Reis AP. Asthma mortality in children and adolescents of Brazil over a 20-year period. Jornal De Pediatria (Versão em Português). 2020;96(4):432-438. Doi:10.1016/j.jpedp.2019.05.014
3. Sabar MF, Akram M, Awan FI, Ghani MU, Shahid M, Iqbal Z, et al. Awareness of Asthma Genetics in Pakistan: A review with some recommendations. Advancements in Life Sciences. 2018;6(1):1-0. Doi:10.62940/als.v6i1.295
4. Anjum MS, Ali SM, Subhani MA, Anwar MN, Nizami AS, Ashraf U, et al. An emerged challenge of air pollution and ever-increasing particulate matter in Pakistan; a critical review. Journal of Hazardous Materials. 2021;402:123943. Doi.10.1016/j.jhazmat.2020.123943
5. Mosnaim G. Asthma in adults. New England Journal of Medicine. 2023;389(11):1023-1031. Doi:10.1056/NEJMcp2304871
6. Wang R, Murray CS, Fowler SJ, Simpson A, Durrington HJ. Asthma diagnosis: into the fourth dimension. Thorax. 2021;76(6):624-631. Doi:10.1136/thoraxjnl-2020-216421
7. Zajac D, Wojciechowski P. The role of vitamins in the pathogenesis of asthma. International Journal of Molecular Sciences. 2023;24(10):8574. Doi:10.3390/ijms24108574
8. Ayakannu R, Abdullah NA, Radhakrishnan AK, Raj VL, Liam CK. Relationship between various cytokines implicated in asthma. Human Immunology.2019;80(9):755-763.Doi:10.1016/j.humimm.2019.04.018
9. Amrein K, Scherkl M, Hoffmann M, Neuwersch-Sommeregger S, Köstenberger M, Tmava Berisha A, et al. Vitamin D deficiency 2.0: an update on the current status worldwide. European Journal of Clinical Nutrition.2020;74(11):1498-1513.Doi:10.1038/s41430-020-0558-y
10. Ao T, Kikuta J, Ishii M. The effects of vitamin D on immune system and inflammatory diseases. Biomolecules. 2021;11(11):1624.Doi:10.3390/biom11111624
11. Antonio Buendia J, Rodriguez-Martinez CE, Sossa-Briceño MP. Cost utility of vitamin D supplementation in adults with mild to moderate asthma. Journal of Asthma. 2023;60(5):951-959. Doi:10.1080/02770903.2022.2110113
12. Wang M, Liu M, Wang C, Xiao Y, An T, Zou M, et al. Association between vitamin D status and asthma control: a meta-analysis of randomized trials. Respiratory medicine. 2019;150:85-94.Doi:10.1016/j.rmed.2019.02.016
13. Ogeyingbo OD, Ahmed R, Gyawali M, Venkatesan N, Bhandari R, Botleroo RA, et al. The relationship between vitamin D and asthma exacerbation. Cureus. 2021;13(8):e17279. Doi: 10.7759/cureus.17279
14. Forno E, Bacharier LB, Phipatanakul W, Guilbert TW, Cabana MD, Ross K, et al. Effect of vitamin D3 supplementation on severe asthma exacerbations in children with asthma and low vitamin D levels: the VDKA randomized clinical trial. Jama. 2020;324(8):752-60. Doi:10.1001/jama.2020.12384
15. Riaz H, Finlayson AE, Bashir S, Hussain S, Mahmood S, Malik F, et al. Prevalence of Vitamin D deficiency in Pakistan and implications for the future. Expert Review of Clinical Pharmacology. 2016;9(2):329-338. Doi:10.1586/17512433.2016.1122519
16. Martineau AR, Jolliffe DA, Hooper RL, Greenberg L, Aloia JF, Bergman P, et al. Vitamin D supplementation to prevent acute respiratory tract infections: systematic review and meta-analysis of individual participant data. BMJ. 2017;356:i6583. Doi:10.1136/bmj.i6583
17. Zhu Y, Jing D, Liang H, Li D, Chang Q, Shen M, et al. Vitamin D status and asthma, lung function, and hospitalization among British adults. Frontiers in nutrition. 2022;9:954768. Doi:10.3389/fnut.2022.954768
18. Al-Thagfan SS, Alolayan SO, Ahmed S, Emara MM, Awadallah MF. Impacts of deficiency in vitamin D derivatives on disease severity in adult bronchial asthma patients. Pulmonary Pharmacology & Therapeutics. 2021;70:102073. Doi:10.1016/j.pupt.2021.102073
19. Martineau AR, MacLaughlin BD, Hooper RL, Barnes NC, Jolliffe DA, Greiller CL, et al. Double-blind randomised placebo-controlled trial of bolus-dose vitamin D3 supplementation in adults with asthma (ViDiAs). Thorax. 2015;70(5):451-457. Doi:10.1136/thoraxjnl-2014-206449

20. Korn S, Hübner M, Jung M, Blettner M, Buhl R. Severe and uncontrolled adult asthma is associated with vitamin D insufficiency and deficiency. Respiratory Research. 2013;14(1):25. Doi:10.1186/1465-9921-14-25

21. Beyhan-Sagmen S, Baykan O, Balcan B, Ceyhan B. Association between severe vitamin D deficiency, lung function and asthma control. Archivos de Bronconeumología (English Edition).2017;53(4):186-191.Doi:10.1016/j.arbr.2016.11.002

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Sara Bano: Substantial contributions to the conception and design of the work.
Hafiza Faiza Rauf : Acquisition and analysis of data for the work.
Shazia Shakoor: Interpretation of data for the work
Aasia Ismail: Drafting the work.
Fahad Usman: Reviewing it critically for important intellectual content.
Sadia Rehman: Final approval of the version to be published.