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ORIGINAL ARTICLE

Vitamin D Deficiency in Vitiligo: A Cross-Sectional Analysis of Prevalence and Predictors

SYED BILAL AHMED[1], SAJIDA JABEEN[2], ASADULLAH KHAN[3], NEELAM AYUB[4]
[1]*Assistant Professor PGMIQ/ BMC Hospital Quetta*
[2]*Assistant Professor Biochemistry Bolan Medical College Quetta*
[3]*Assistant professor, Department of Rheumatology Bolan Medical College Quetta*
[4]*Assistant Professor Dermatology, Rawal Medical college Islamabad*
Correspondence to: Sajida Jabeen, Email: dr.sajida.jabeen@gmail.com

ABSTRACT

Background: Vitamin D deficiency is a global health issue and has been implicated in autoimmune and pigmentary disorders, including vitiligo. However, prevalence estimates and associations with disease severity remain inconsistent.

Objective: To assess the frequency and severity of vitamin D deficiency among vitiligo patients and to evaluate demographic and clinical predictors.

Methods: This cross-sectional study included 165 vitiligo patients attending dermatology clinic from Dec 2022 to May 2023. Serum 25-hydroxyvitamin D [25(OH)D] was measured using chemiluminescent immunoassay and categorized as deficient (<20 ng/mL), insufficient (20–29 ng/mL), or sufficient (≥30 ng/mL). Demographic and clinical data were recorded. Logistic regression was applied to identify independent predictors of vitamin D deficiency.

Results: Of 165 patients (mean age 34.2 ± 11.5 years; 59.4% female), 23.0% were deficient, 38.8% insufficient, and 38.2% sufficient. Female sex, indoor occupation, and winter recruitment were significantly associated with deficiency ($p<0.05$). Multivariate logistic regression showed that indoor occupation (OR 2.45, 95% CI 1.11–5.40, $p=0.027$) and winter season (OR 2.12, 95% CI 1.01–4.47, $p=0.046$) independently predicted deficiency. No significant association was observed between vitamin D status and vitiligo severity index.

Conclusion: Vitamin D deficiency and insufficiency affect nearly two-thirds of vitiligo patients. Risk is highest in women, indoor workers, and those recruited in winter, but serum vitamin D was not associated with disease severity. Screening and preventive measures may be warranted in high-risk groups.

Keywords: Vitiligo, Vitamin D deficiency, Frequency, Logistic regression, Risk factors

INTRODUCTION

Vitiligo is a chronic depigmenting disorder characterized by loss of functional melanocytes, with a global prevalence of 0.5–2%[1]. Although its exact pathogenesis remains unclear, autoimmune, genetic, oxidative stress, and environmental mechanisms contribute to disease onset and progression[2–4]. Vitamin D, a secosteroid hormone obtained through cutaneous synthesis and dietary sources, exerts pleiotropic effects on melanogenesis, keratinocyte proliferation, and immune modulation[5–7].

Deficiency of vitamin D is a recognized global public health problem, affecting an estimated one billion individuals worldwide[8]. It has been implicated in the pathogenesis of several autoimmune diseases including multiple sclerosis, type 1 diabetes, and alopecia areata[9–11]. Given its immunomodulatory properties, interest in vitamin D status in vitiligo has grown.

Several observational studies suggest a higher prevalence of vitamin D deficiency among vitiligo patients compared to controls[12–14], while others have reported no significant differences[15,16]. Furthermore, the relationship between vitamin D levels and clinical severity of vitiligo, assessed by Vitiligo Area Scoring Index (VASI), remains controversial[17–19]. Factors such as latitude, seasonal variation, clothing practices, and skin phototype further complicate interpretation[20–22].

Despite growing evidence, there remains limited data on the frequency, severity, and determinants of vitamin D deficiency among vitiligo patients in developing regions. This study aimed to assess the frequency and severity of deficiency in a cohort of vitiligo patients and evaluate demographic, clinical, and lifestyle factors associated with low vitamin D levels using logistic regression analysis.

METHODOLOGY

A hospital-based cross-sectional study was conducted in the dermatology department of PGMIQ/ BMC Hospital Quetta, from December 2022 to May 2023. Written informed consent was obtained from all participants. Total 165 consecutive adult patients with clinically diagnosed vitiligo were recruited using non-probability consecutive sampling.

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Eligibility:

- Inclusion: age ≥18 years, any vitiligo subtype, not on vitamin D supplementation.
- Exclusion: patients with chronic renal/hepatic/endocrine disorders, pregnant women, or those on immunosuppressants.

Data Collection: Demographic data including age, sex, occupation, body mass index (BMI), and season of presentation were obtained. Clinical details such as disease duration, vitiligo subtype, and severity using the Vitiligo Area Scoring Index (VASI) were recorded. Lifestyle data (indoor vs outdoor occupation, sun exposure) were noted. Venous blood samples were collected, and serum 25(OH)D was measured using chemiluminescent immunoassay. Vitamin D status was classified as deficient (<20 ng/mL), insufficient (20–29 ng/mL), or sufficient (≥30 ng/mL).

Laboratory Assessment:

Serum 25(OH)D measured by chemiluminescent immunoassay. Cutoffs:

- Deficient <20 ng/mL
- Insufficient 20–29 ng/mL
- Sufficient ≥30 ng/mL [Holick et al., Endocrine Society Guidelines].

Statistical Analysis: Data were analyzed using SPSS version 25. Means and standard deviations were calculated for continuous variables, and proportions for categorical data. Chi-square tests assessed group differences. Logistic regression analysis was performed with vitamin D deficiency as the dependent variable (yes/no). Independent variables included sex, age, BMI, occupation, season of presentation, disease duration, and vitiligo subtype. Results were presented as odds ratios (OR) with 95% confidence intervals (CI). $p<0.05$ was considered statistically significant.

RESULTS

A total of 165 patients were analyzed. Mean age was 34.2 ± 11.5 years (range 18–65). Females comprised 59.4% (n=98). Indoor

workers constituted 45.5%. Winter recruitment accounted for 29.1% of cases. Mean disease duration was 6.8 ± 4.2 years.

38 patients (23.0%) were deficient, 64 (38.8%) insufficient, and 63 (38.2%) sufficient. Mean serum 25(OH)D was 25.4 ± 8.2 ng/mL.

Table 1: Demographic and clinical characteristics by Vitamin D status

Variable	Deficient n=38	Insufficient n=64	Sufficient n=63	p-value
Age <35 yrs	24 (63.2%)	38 (59.4%)	32 (50.8%)	0.21
Female sex	28 (73.7%)	42 (65.6%)	28 (44.4%)	0.01
Indoor occupation	24 (63.2%)	35 (54.7%)	16 (25.4%)	0.001
Winter presentation	19 (50.0%)	27 (42.2%)	15 (23.8%)	0.02
Mean BMI (kg/m²)	27.1 ± 3.4	26.2 ± 3.1	25.8 ± 2.9	0.08
Mean VASI score	7.8 ± 3.6	8.1 ± 3.9	7.5 ± 3.4	0.62

Logistic regression analysis demonstrated that indoor occupation independently predicted vitamin D deficiency (OR 2.45, 95% CI 1.11–5.40, p=0.027), as did winter season of presentation (OR 2.12, 95% CI 1.01–4.47, p=0.046). Female sex showed increased odds but did not reach statistical significance after adjustment (OR 1.65, 95% CI 0.81–3.34, p=0.16). Neither age, BMI, nor disease duration were significant predictors. Importantly, vitamin D status showed no significant association with VASI scores.

Table 2: Predictors of Vitamin D deficiency (multivariate logistic regression)

Predictor	OR (95% CI)	p-value
Female sex	1.65 (0.81–3.34)	0.16
Indoor occupation	2.45 (1.11–5.40)	0.027
Winter presentation	2.12 (1.01–4.47)	0.046
Age <35 yrs	1.29 (0.63–2.64)	0.48
BMI ≥27 kg/m²	1.41 (0.68–2.91)	0.35
Disease duration >5y	0.92 (0.45–1.89)	0.82

Indoor occupation and winter presentation emerged as independent predictors of vitamin D deficiency.

DISCUSSION

This study found that 61.8% of vitiligo patients had deficient or insufficient vitamin D levels, consistent with prior research demonstrating widespread deficiency in this population[7,8,11]. The prevalence observed aligns with studies from South Asia and the Middle East, where sunlight exposure is paradoxically high but deficiency remains common due to sociocultural factors[12,13].

Indoor occupation and winter presentation emerged as independent predictors. Reduced UVB exposure among indoor workers has been widely documented as a determinant of vitamin D deficiency[14,15]. Seasonal variation in serum vitamin D is well established, with nadirs during winter months[16,17]. Our findings reinforce the importance of considering occupational and seasonal risk when screening vitiligo patients.

Although females showed higher rates of deficiency, sex was not an independent predictor after adjustment. However, other studies consistently report female predominance, often attributed to clothing practices and cultural behaviors limiting sun exposure[18,19]. This suggests our study may have been underpowered to confirm this association.

We did not find an association between vitamin D levels and vitiligo severity, consistent with Silverberg et al.[9] and Doss et al.[8]. This supports the growing consensus that while deficiency is common, it may not directly influence disease activity or extent. Recent Mendelian randomization studies also failed to demonstrate a causal link between low vitamin D and vitiligo development[20].

Despite uncertain effects on vitiligo progression, vitamin D deficiency carries systemic risks including bone loss, impaired immunity, and increased cardiometabolic burden[21,22]. Routine screening in high-risk groups, especially indoor workers and those presenting in winter, may be beneficial. Supplementation trials in vitiligo have reported mixed results, with some suggesting improvement in repigmentation when combined with phototherapy[23–25].

Clinical Implications: Despite uncertain effects on vitiligo progression, vitamin D deficiency carries systemic risks including bone loss, impaired immunity, and increased cardiometabolic burden[21,22]. Routine screening in high-risk groups, especially indoor workers and those presenting in winter, may be beneficial. Supplementation trials in vitiligo have reported mixed results, with some suggesting improvement in repigmentation when combined with phototherapy[23–25].

Strengths and Limitations: Strengths include a relatively large sample and use of regression analysis to identify independent predictors. Limitations include the cross-sectional design, absence of a control group, and lack of dietary or genetic assessment.

Future Directions: Randomized controlled trials assessing the effect of vitamin D supplementation on repigmentation and disease activity in stratified groups (deficient vs sufficient) are warranted.

CONCLUSION

Vitamin D deficiency and insufficiency are highly prevalent among vitiligo patients, affecting nearly two-thirds of this cohort. Indoor occupation and winter season significantly increased risk, whereas age, BMI, and disease duration were not independent predictors. No association was found between vitamin D status and vitiligo severity. These findings suggest that routine screening and preventive strategies may be considered for high-risk vitiligo patients, not necessarily for disease control but for overall health benefits.

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