

Evaluation of Serum Vitamin D Status in Patients with Vitiligo: A Prospective Case–Control Study from North India

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Keywords:

Vitiligo; Vitamin D; 25-hydroxyvitamin D; Autoimmunity; Case–control study; Melanocytes.

Abstract:

Background: Vitiligo is an autoimmune pigmentary disorder in which vitamin D may influence melanocyte survival, melanogenesis, and immune regulation. However, studies evaluating the association between vitamin D deficiency and vitiligo have reported inconsistent findings. **Objectives:** To compare serum 25-hydroxyvitamin D [25(OH)D] levels between patients with non-segmental vitiligo and healthy controls and to evaluate their association with clinical characteristics of vitiligo. **Materials and Methods:** A prospective case–control study was conducted at a tertiary care hospital in North India from February 2025 to February 2026. Thirty treatment-naïve patients with non-segmental vitiligo and 30 age- and sex-matched healthy controls were enrolled. Serum 25(OH)D levels were measured using electrochemiluminescence. Vitamin D status was categorized as deficient (<20 ng/mL), insufficient (20–30 ng/mL), and sufficient (31–70 ng/mL). Statistical analysis was performed using SPSS, with $P < 0.05$ considered statistically significant. **Results:** The mean age of patients with vitiligo was 26.67 ± 16.20 years. Mean serum 25(OH)D levels were significantly lower in cases than in controls (19.6 ± 10.9 ng/mL vs. 27.6 ± 12.7 ng/mL; $P = 0.021$). Vitamin D deficiency was observed in 56.7% of patients with vitiligo compared with 23.3% of controls, while sufficient vitamin D levels were present in 23.3% and 53.3%, respectively. No significant association was observed between serum vitamin D levels and sex, clinical type of vitiligo, or associated autoimmune diseases. **Conclusion:** Patients with non-segmental vitiligo had significantly lower serum 25(OH)D levels than healthy controls, supporting an association between vitamin D deficiency and vitiligo. Assessment of vitamin D status at diagnosis may be beneficial, and supplementation should be considered in deficient individuals. Larger longitudinal studies are required to clarify whether correction of vitamin D deficiency influences disease onset, progression, or treatment outcomes.

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Background:

Vitiligo is an acquired, chronic skin disorder characterized by the progressive loss of melanocytes resulting in emergence of well-defined, white depigmented or achromic macules and patches on the skin. It affects approximately 0.1–2% of the global population, with no significant differences by gender or ethnicity, though onset occurs before age 30 in over 60% of cases [1]. While not life-threatening, vitiligo carries a substantial psychological burden comparable to that of

eczema or psoriasis. The condition is widely considered autoimmune in nature: dysfunctional melanocytes trigger immune responses that lead to their own destruction [2]. Genetic predisposition and concurrent autoimmune diseases (e.g., thyroiditis, type 1 diabetes, pernicious anemia) are common risk factors and 30% cases of vitiligo have an associated autoimmune condition [3].

Several studies suggest that individuals with vitiligo have a higher prevalence of vitamin D deficiency compared to

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the general population [4]. This may be partly attributed to reduced sun exposure, as patients often limit sunlight to prevent further depigmentation, thereby decreasing endogenous vitamin D synthesis. Such deficiency can contribute to immune dysregulation, potentially influencing disease progression. Melanocytes are known to express vitamin D receptors and vitamin D₃ enhances tyrosinase activity and stimulates melanogenesis which may aid in the repigmentation of vitiligo lesions [5]. Additionally, vitamin D analogues such as calcipotriol and tacalcitol have been shown to promote repigmentation in affected patients.

Vitamin D exhibits immunomodulatory effects, including the inhibition of pro-inflammatory cytokines such as interleukin (IL)-6, IL-8, tumor necrosis factor (TNF)- α , and TNF- γ . Furthermore, the active form of vitamin D has been found to reduce UVB-induced apoptosis in melanocytes, thereby supporting their survival and function indicating that vitamin D supplementation may be helpful in vitiligo. This, in turn, could enhance melanin production and facilitate repigmentation in affected individuals. Moreover, the antioxidant properties of vitamin D may help reduce oxidative stress—an important factor in vitiligo pathogenesis—thereby potentially slowing or preventing further progression of the disease. Orally administered vitamin D is converted to 25-hydroxyvitamin D [25(OH)D] and released into the bloodstream; thus, serum 25(OH)D concentrations serve as a reliable marker of vitamin D status. As a principal fraction of total 25(OH)D, circulating 25-hydroxyvitamin D₃ [25(OH)D₃] is also widely used to evaluate overall vitamin D status. Therefore, the present study was conducted to ascertain any relationship between vitiligo and vitamin D metabolism in comparison to healthy controls.

Materials & Methods

This prospective case control study was held in a tertiary care hospital in North India between February 2025 to February 2026 for a period of one year. After obtaining approval from hospital's institutional review board, thirty clinically diagnosed patients of Vitiligo in the age group < 60 years were included in the study. Vitiligo was diagnosed on the basis of clinical findings. The same number of age and gender matched vitiligo free controls were included from other patients attending dermatology out patient department (OPD). Similar inclusion criteria were applied for controls with the exception of the presence of vitiligo or other autoimmune diseases. An informed written consent was taken from all participants. The relevant demographic data of participants were gathered and collected on a predesigned proforma. Blood samples of cases and controls were collected for Serum vitamin D levels at the same time of year to avoid

seasonal variability in Serum Vitamin D levels and sent to Clinical laboratory. The laboratory personnel were blinded to the case controls and all samples were handled in a similar manner. Serum vitamin D levels were measured via the electrochemiluminescence method using commercial kits.

Regarding serum vitamin D levels, the subjects were categorized into four groups: deficient who had vitamin D levels <20 ng/ml, insufficient who had vitamin D levels between 20 to 30 ng/ml, normal who had vitamin D levels between 31 to 70 ng/ml and toxic levels above 100 ng/ml.

Inclusion criteria:

Age less than 60 years

Both sexes.

All cases of Vitiligo who presented to Skin OPD who were not on any treatment for the last 6 months

Exclusion criteria:

1. Patients receiving vitamin D treatment > 6 months.
2. Individuals with other co-morbidities, such as heart failure, chronic kidney disease, malabsorption, or endocrine diseases.
3. Patients receiving steroid therapy for more than three months, as verified by documented medical prescriptions or clinical records.
4. Pregnancy and lactation.
5. Segmental vitiligo.

Statistical analysis:

A software for statistical analysis, SPSS version was used. The p-value was deemed statistically significant if it was less than 0.05.

Results

Sixty participants were enrolled into the current study with 30 cases and controls each. There were 18 females and 12 males among the vitiligo cases and controls each. The most common age group in cases was 15-30 years of age with 10 cases (33.33%) followed by 1-15 years with 9 (30%) cases while least number of cases were in 41-60 years age group. (Table 1) The mean age of vitiligo cases was 26.67 ± 16.20 years. There was no significant difference between cases and controls in terms of mean age. The maximum duration of disease was 4 years while minimum duration was 2 months. Among the 30 cases of vitiligo, there were 14 cases of generalized vitiligo, 5

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cases of acrofacial vitiligo and 11 cases of focal vitiligo. Five cases had Hypothyroidism and two patients had type 2 diabetes mellitus. Vitamin D deficiency was observed in both cases and controls. The participants and their Mean $\pm$ SD serum levels of vitamin D have been demonstrated in Table 2. The Serum Vitamin D levels were deficient in 17 cases (56.66%), insufficient in 6 (20%), and sufficient in 7 (23.33%). Among the controls, there were 7 people with deficient vitamin D levels (23.33%), 7 with insufficient (23.33%), and 16 with sufficient (53.33%) vitamin D levels. There was no cases and controls with toxic levels of Vitamin D. The patients of vitiligo had a slightly lower mean level of Serum Vitamin D and a slightly higher percentage of deficiency which was statistically significant. We did not find any association between vitamin D levels and sex, type of vitiligo and presence of autoimmune disease in cases as demonstrated in Table 1.

Discussion

Vitamin D is a fat-soluble vitamin synthesised in the skin following ultraviolet light exposure. It has been widely utilized in the treatment of psoriasis, vitiligo, and other skin disorders. The active metabolite, 1,25-dihydroxyvitamin D₃, plays a key role in calcium and bone homeostasis and also regulates cellular proliferation and differentiation, along with exerting important immunomodulatory effects. The aetiopathogenesis of vitiligo suggest an autoimmune and neurogenic mediated mechanism. There is low levels of circulating vitamin D reported in vitiligo and other autoimmune diseases, but it remains unclear whether this is a cause or result of autoimmune diseases. There are very few studies evaluating serum vitamin D levels in vitiligo patients.

In the current study, the mean age of vitiligo cases was 26.67 ± 16.20 years which aligns with the known epidemiology of vitiligo, which has an onset in the second or third decade of life [6]. There was lower serum vitamin D levels in patients with vitiligo in comparison to controls; this difference was statistically significant. Both the patients and controls had low circulating vitamin D levels with the mean values being 19.6 ± 10.9 ng/mL and 27.6 ± 12.7 ng/mL respectively. Takci et al. in a case control study on Vitiligo revealed that Serum Vitamin D levels were significantly lower in cases than the controls [7]. In the study by Silverberg et al., 55.6% of the patients with vitiligo had insufficient (<30 ng/mL) and 13.3% had very low (<15 ng/mL) vitamin D levels [8]. In a comparative study by Karagun et al. [9] and Ustun et al. [10], patients of vitiligo had lower Serum Vitamin D levels than controls although the difference was not significant. A meta analysis demonstrated a significant link between reduced 25-hydroxyvitamin D levels and vitiligo; however, it does not establish a causal relationship [11]. The findings underscore the value of

assessing 25-hydroxyvitamin D levels in patients with vitiligo though further research is needed to determine whether vitamin D supplementation can improve clinical outcomes in vitiligo.

Our study found no association of Serum Vitamin D levels with sex, type of vitiligo and presence of autoimmune disease. In a study done by Saleh et al., no correlation was observed between associated autoimmune disease and serum Vitamin D levels [12]. A metaanalysis was done to associate Serum Vitamin D levels with various factors like vitiligo type, skin type, disease activity, vitiligo history, autoimmune comorbidities, age, indoor-outdoor work, sun exposure, seasonal variations, and Vit-D measurement methods [11]. There was no statistically significant difference in Vitamin D levels between different types of non-segmental vitiligo, VASI, autoimmune comorbidities, age, gender and disease duration as observed in the meta-regression analysis. The only significant difference was observed between indoor/urban vitiligo patients having low vitamin D levels when compared to their outdoor/rural counterparts. In the present study, most of the participants were from rural areas, so this comparison was not possible.

Conclusion

The current study adds to the growing recognition of an inter-play between vitiligo, autoimmunity, and vitamin D status. Measurement of serum levels of vitamin D at the time of diagnosis of vitiligo is recommended and vitamin D supplementation is suggested for the patients with low levels of Serum Vitamin D. Further studies with larger sample sizes and cohort studies are recommended to investigate the effects of vitamin D deficiency and vitamin D supplementation on the incidence of vitiligo.

Declarations

Author Contributions: Dr. Pooja Bains conducted the study, gathered data, performed analysis, and wrote the manuscript.

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Ethics Approval: Ethical approval has been taken.

Patient Consent: Informed written consent was taken from all participants.

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Tables and Legends

Table Legends:

Table 1: Demographic Data, Clinical Characteristics of Vitiligo Patients

Table 2: Serum 25-Hydroxyvitamin D Levels of All Vitiligo Patients and Controls.

Table 1: Demographic Data, Clinical Characteristics of Vitiligo Patients

Parameter	Subgroup (n)	Mean Vitamin D $\pm$ SD	P value
Sex	Male (12)	17.21 $\pm$ 9.47	0.32
	Female (18)	21.17 $\pm$ 11.79	
Type of Vitiligo	Generalized (14)	23.94 $\pm$ 12.31	0.09
	Focal (11)	17.56 $\pm$ 9.51	
	Acrofacial (5)	12.24 $\pm$ 5.18	
Autoimmune disease	Negative (23)	18.94 $\pm$ 10.88	0.35
	Positive (7)	23.26 $\pm$ 10.13	

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Table 2. Serum 25-Hydroxyvitamin D Levels of All Vitiligo Patients and Controls.

Vitamin D levels	Cases	Controls
<20 deficient	17	7
20-30 insufficient	6	7
31-70 normal	7	16
Mean $\pm$ SD	19.6 $\pm$ 10.9 ng/mL	27.6 $\pm$ 12.7 ng/mL
P value	0.021 (significant)	