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THE CLINICAL EFFECT OF ORAL VITAMIN D_3 SUPPLEMENTATION ON PSORIASIS PATIENTS ATTENDING OUTPATIENT TERTIARY CARE CENTRE

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ABSTRACT

Background: Psoriasis is a chronic immune-mediated inflammatory skin disease characterized by hyperproliferation of keratinocytes and dysregulated immune responses. Emerging evidence suggests a link between vitamin D deficiency and increased disease severity in psoriasis due to its role in epidermal homeostasis and immune modulation. However, the therapeutic efficacy of oral vitamin D_3 supplementation in Indian patients with chronic plaque-type psoriasis remains underexplored. The present study aimed to evaluate the clinical efficacy and safety of oral vitamin D_3 supplementation in patients with chronic plaque psoriasis and low baseline serum vitamin D levels.

Methods: This prospective interventional study included 100 adult patients with chronic plaque-type psoriasis and documented serum 25(OH)D levels <30 ng/mL. Participants received oral vitamin D_3 (60,000 IU weekly) for 6 months, without systemic antipsoriatic therapy. Clinical severity was assessed using the Psoriasis Area and Severity Index (PASI), while serum vitamin D levels were monitored at baseline, 3 months, and 6 months. Statistical analyses included paired t-tests, ANOVA, Pearson correlation, and independent samples t-tests.

Results: Mean serum vitamin D levels increased from 17.42 ng/mL to 40.85 ng/mL over 6 months ($p<0.001$), while mean PASI scores declined from 8.84 to 3.69 ($p<0.001$), demonstrating significant clinical improvement. A moderate, statistically significant inverse correlation ($r = –0.527$, $p<0.01$) was found between vitamin D levels and PASI scores. Improvement was comparable across age groups, skin types (Fitzpatrick III vs IV, $p=0.691$), and baseline PASI severity ($p=0.091$). Patients with severe baseline disease showed the greatest mean improvement (65.8%). No serious adverse events were reported, with mild side effects (nausea, constipation) noted in 28% of patients.

Conclusion: Oral vitamin D_3 supplementation is a safe, effective, and well-tolerated adjunctive treatment for chronic plaque psoriasis, demonstrating consistent clinical benefit irrespective of age, skin type, or baseline disease severity. These findings support routine screening for vitamin D

deficiency in psoriasis and its correction as part of comprehensive management. Further large-scale, randomized studies are recommended to validate these results and explore combinatory therapeutic approaches.

***Keywords**:* Psoriasis, Vitamin D_3, Oral supplementation, PASI score, 25-hydroxyvitamin D, Chronic plaque psoriasis

INTRODUCTION

Psoriasis is a chronic, immune-mediated inflammatory skin disease affecting approximately 1–3% of the global population. It commonly presents as erythematous, scaly plaques predominantly on the scalp, knees, elbows, and lower back. [1] The hallmark histopathological features include epidermal hyperproliferation, abnormal keratinocyte differentiation, and a mixed inflammatory infiltrate consisting of dendritic cells, macrophages, and T lymphocytes in the dermis [2].

Among the prevailing theories explaining its pathogenesis, the T-cell-mediated immune response remains central, with both innate and adaptive immune pathways contributing to sustained cutaneous inflammation. Cells such as plasma dendritic cells, Th17 subsets producing IL-17A/F, IL-21, and IL-6, along with macrophages and regulatory T cells, release cytokines including IFN-γ, TNF-α, and IL-23 that maintain and amplify the psoriatic phenotype. [2]

Vitamin D plays a dual role in skin biology as both a locally synthesized hormone and a key modulator of epidermal homeostasis. Its active form, 1,25-dihydroxyvitamin D_3 ($1,25(OH)_2D_3$), synthesized through hepatic and renal hydroxylation of vitamin D, binds to vitamin D receptors (VDR) expressed in keratinocytes and immune cells [3–5]. This ligand-receptor interaction regulates the proliferation and differentiation of keratinocytes, induces apoptosis, and reinforces skin barrier integrity by modulating glucosylceramide synthesis. In addition to its direct effects on skin structure, vitamin D suppresses T cell proliferation and promotes the development of regulatory T cells, thus attenuating inflammatory cascades in psoriatic lesions [6–8].

These immunomodulatory and keratinocyte-regulating actions have justified the incorporation of topical vitamin D analogues into standard psoriasis treatment regimens since the mid-1980s [9,10]. Despite this, systemic (oral) supplementation of vitamin D, especially in vitamin D-deficient patients with psoriasis, remains underexplored—particularly in Asian populations. Studies have increasingly demonstrated that serum 25-hydroxyvitamin D (25(OH)D) levels are significantly lower in patients with psoriasis compared to healthy individuals [11–13], suggesting that altered vitamin D metabolism may play a contributing role in the disease's pathophysiology [14,15].

Psoriasis is also recognized as a multisystem inflammatory disorder associated with comorbid conditions such as psoriatic arthritis, obesity, metabolic syndrome, cardiovascular, and cerebrovascular diseases [16–18]. Given these broad systemic implications and the known pleiotropic effects of vitamin D in immune regulation, it is biologically plausible that correcting vitamin D deficiency might ameliorate not only cutaneous lesions but also systemic inflammation.

Despite growing global evidence, there is limited clinical data from India evaluating the therapeutic efficacy of oral vitamin D_3 supplementation in psoriasis. Considering regional and ethnic variations in sun exposure, dietary intake, skin type, and vitamin D metabolism, this study aims to investigate the clinical effect of oral vitamin D_3 supplementation on disease severity and serum vitamin D status among patients with chronic plaque-type psoriasis attending an outpatient tertiary care centre in central India.

MATERIAL AND METHODS

This was a prospective, before-and-after interventional study conducted at the Department of Dermatology, Index Medical College Hospital and Research Centre, Indore, over a period of 12 months from April 2024 to March 2025. A total of 100 patients diagnosed with chronic plaque-type psoriasis and meeting the eligibility criteria were enrolled after obtaining written informed consent.

The study was approved by the Institutional Ethics Committee and adhered to the principles outlined in the Declaration of Helsinki.

Inclusion Criteria

- Patients aged 18 years or older with clinically confirmed chronic plaque psoriasis.
- Patients with documented low serum 25-hydroxyvitamin D [25(OH)D] levels (<30 ng/mL).
- Willingness to comply with study visits and follow-up schedule.

Exclusion Criteria

- Patients with hepatic or renal failure.
- Individuals with known malabsorption syndromes.
- History of nephrolithiasis (kidney stones) or hypercalcemia.
- Elevated parathyroid hormone levels.
- Pregnant or lactating women.
- Patients on immunosuppressive agents or systemic medications including thiazide diuretics, antiepileptics, anticoagulants, or bisphosphonates.
- Prior or current intake of vitamin D supplements >1000 IU/day within the last 2 months.
- Patients who had undergone phototherapy within the last 4 weeks.

Intervention and Follow-Up

All enrolled participants received oral vitamin D_3 supplementation in the form of 60,000 IU weekly for a total duration of 6 months. Patients continued their baseline topical treatment regimens but no systemic or phototherapy interventions were initiated during the study period.

Assessment Parameters

Clinical severity of psoriasis was evaluated using the Psoriasis Area and Severity Index (PASI) at baseline, 3 months, and 6 months. PASI scores were categorized as:

- Mild psoriasis: PASI <7
- Moderate psoriasis: PASI 7–12
- Severe psoriasis: PASI >12

Serum 25(OH)D levels were measured at baseline, 3 months, and 6 months using a chemiluminescence-based assay. The vitamin D status was categorized as:

- Severe deficiency: <20 ng/mL
- Insufficiency: 21–29 ng/mL
- Sufficiency: 30–100 ng/mL
- Toxicity: >100 ng/mL

Demographic data including age, gender, skin type (Fitzpatrick classification), medical history, comorbidities, and concurrent medications were recorded using a structured questionnaire. Adverse effects were monitored during each follow-up visit, including symptoms such as thirst, nausea, constipation, vomiting, and more serious signs like cardiac arrhythmias, weight loss, polyuria, or loss of appetite.

Statistical Analysis

Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) and categorical variables as frequencies and percentages. The change in PASI scores and serum vitamin D levels over time was analyzed using the paired t-test and ANOVA for repeated measures where applicable. A p-value <0.05 was considered statistically significant.

RESULTS

Among the 100 enrolled patients with chronic plaque psoriasis and low serum vitamin D levels, there was a balanced gender distribution with a slight male predominance (52%). The mean age of the study participants was 38.7 $\pm$ 11.4 years. The majority of participants were aged between 26 and

35 years (32%), followed by 46–55 years (20%), indicating a higher prevalence among young to middle-aged adults. Regarding skin tone, Fitzpatrick type III was observed in 56% of patients, while 44% had type IV, suggesting that intermediate skin phototypes were more prevalent in this population. The mean BMI was 26.4 $\pm$ 4.7 kg/m², indicating that a substantial portion of the cohort was overweight or obese—an important consideration given the link between obesity and psoriasis severity.

Table 1: Demographic Distribution of Study Population (n = 100)

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	52	52%
	Female	48	48%
Age Group (Years)	≤25	18	18%
	26–35	32	32%
	36–45	14	14%
	46–55	20	20%
	>55	16	16%
BMI (kg/m²)	<18.5 (Underweight)	6	6.0%
	18.5–24.9 (Normal)	41	41.0%
	25.0–29.9 (Overweight)	33	33.0%
	≥30 (Obese)	20	20.0%
Skin Tone	Fitzpatrick Type III	56	56%
	Fitzpatrick Type IV	44	44%

In respect to changes observed over the treatment duration, there was a progressive and favorable shift in both serum vitamin D levels and PASI scores among the 100 psoriasis patients. The mean vitamin D level increased from 17.42 ng/mL at baseline to 24.31 ng/mL after three months, and further to 40.85 ng/mL by six months, reflecting successful correction of initial deficiency through oral supplementation. Correspondingly, the mean PASI score showed a marked decline from 8.84 at the start to 6.21 at three months, and then to 3.69 at six months, signifying a clear clinical improvement in disease severity. These findings highlight a consistent inverse relationship between rising vitamin D levels and decreasing PASI scores, reinforcing the potential therapeutic benefit of oral vitamin D_3 supplementation in patients with psoriasis. The gradual improvement in both parameters over time affirms the clinical utility of monitoring and correcting vitamin D status as part of psoriasis management.

Table 2: Changes in PASI and Serum Vitamin D Levels Over the Course of Treatment (n = 100)

Parameter	Time Point	Mean	Standard Deviation	Standard Error	Minimum	Maximum
PASI Score	Baseline	8.84	3.18	0.45	3.1	15.6
	After 3 Months	6.21	2.48	0.35	2.5	12.0
	After 6 Months	3.69	2.63	0.37	0.0	9.8
Vitamin D Level	Baseline (ng/mL)	17.42	5.01	0.71	10.3	26.7
	After 3 Months	24.31	4.33	0.61	13.0	29.9
	After 6 Months	40.85	10.66	1.51	11.2	63.4

The correlation analysis conducted on 100 patients revealed a statistically significant inverse relationship between serum vitamin D levels and PASI scores during the treatment period. The Pearson correlation coefficient was –0.527, with a p-value of 0.000, indicating a moderate negative correlation that is highly significant. This implies that as vitamin D levels increased with supplementation over time, there was a corresponding and measurable reduction in the severity of

psoriasis as reflected by decreasing PASI scores. These findings support the hypothesis that improving vitamin D status can positively influence clinical outcomes in patients with psoriasis. [Table 3]

Table 3: Correlation between Vitamin D and PASI Scores During Treatment (n=100)

	PASI Score	Vitamin D Level
PASI Score	Pearson Correlation = 1	–0.527
	Sig. (2-tailed) = –	0.000
Vitamin D	Pearson Correlation = –0.527	1
	Sig. (2-tailed) = 0.000	–

**Note: Correlation is significant at the 0.01 level (2-tailed).*

In relation to the effect of skin tone on therapeutic response, an independent samples t-test was applied. The significance value (p = 0.691) was found to be greater than 0.05, indicating no statistically meaningful difference in the percentage improvement between individuals with Fitzpatrick type III and type IV skin tones following 6 months of oral vitamin D_3 therapy. [Table 4] From the descriptive statistics, patients with Fitzpatrick type III skin exhibited a mean improvement rate of 57.4%, while those with type IV skin showed a comparable mean improvement of 54.6%. These close values support the conclusion that cutaneous pigmentation had no significant impact on treatment efficacy. [Table 5] This analysis reinforces that vitamin D_3 supplementation demonstrated consistent benefits across varied skin tones, suggesting it is a universally effective adjunct in psoriasis management irrespective of skin pigmentation.

Table 4: Independent Samples t-test – Association Between Skin Tone and Clinical Response After 6 Months (N = 100)

Test	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Levene's Test for Equality of Variances	1.462	0.230	0.398	98	0.691	0.028	0.0704

Table 5: Descriptive Statistics – Mean Percentage Improvement by Skin Tone Group

Fitzpatrick Skin Tone Type	No. of Patients (N)	Mean Improvement Rate (After 6 Months)	Standard Deviation	Standard Error Mean
Type III	58	0.574	0.259	0.0340
Type IV	42	0.546	0.288	0.0444

Note: The improvement rate of 50% corresponds to 0.5 ..... and so on in the statistical table).

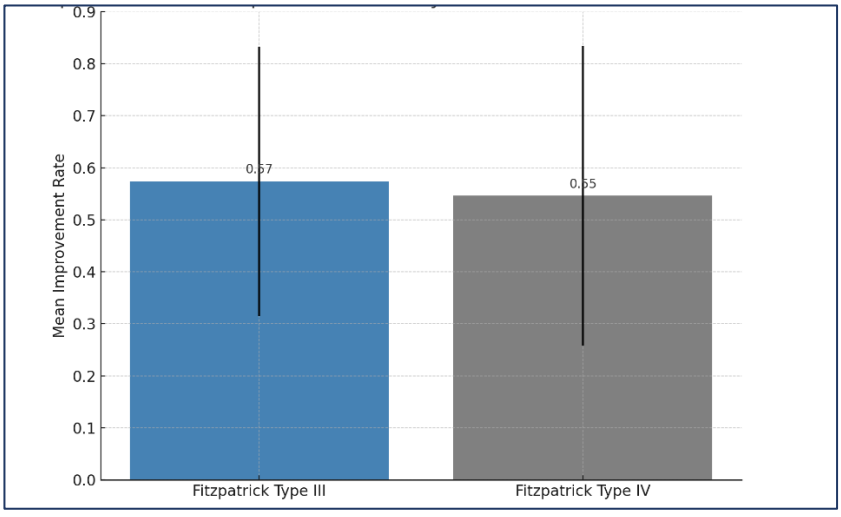

Figure 1. Comparison of Mean Improvement Rate by Skin Tone After 6 Months of Treatment

The ANOVA analysis did not reveal statistically significant differences in treatment response based on patient age ($p = 0.082$) or baseline PASI severity ($p = 0.091$). Although patients of varying age groups and disease severity exhibited differences in improvement percentages, these differences were not statistically significant at the 5% level. This suggests that oral vitamin D supplementation had a broadly consistent therapeutic effect across age groups and initial disease severity in the studied psoriasis cohort.

Table 6: ANOVA – Correlation Between Response to Treatment and Patient Age & PASI Severity at Admission (n = 100)

Variable	Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Patient Age	Between Groups	1.032	4	0.258	2.001	0.082
	Within Groups	12.419	95	0.131		
	Total	13.451	99			
PASI Severity at Admission	Between Groups	0.538	2	0.269	2.489	0.091
	Within Groups	10.762	97	0.111		
	Total	11.300	99			

A rising trend in the mean percentage of improvement with increasing disease severity was observed. Patients with severe psoriasis at baseline showed the highest average improvement (65.80%), followed by those with moderate (57.35%) and mild (46.20%) disease. This suggests that patients with more severe initial disease burden may exhibit a more noticeable clinical response to oral vitamin D therapy over a 6-month period. However, standard deviations indicate variability within each group, and further statistical testing is warranted to confirm significance**.**

Table 7: Descriptive Statistics – Association Between Initial Disease Severity and Percentage Improvement After 6 Months of Vitamin D Therapy

Severity of Psoriasis	N	Mean Improvement (%)	Std. Deviation	Std. Error	95% Confidence Interval for Mean	Min	Max.
Mild	30	46.20%	22.75	4.15	37.71% – 54.69%	5.0%	80.0%
Moderate	40	57.35%	30.82	4.88	47.49% – 67.21%	10.0%	100.0%
Severe	30	65.80%	27.63	5.04	55.50% – 76.10%	25.0%	100.0%
Total	100	56.58%	28.85	2.89	50.87% – 62.29%	5.0%	100.0%

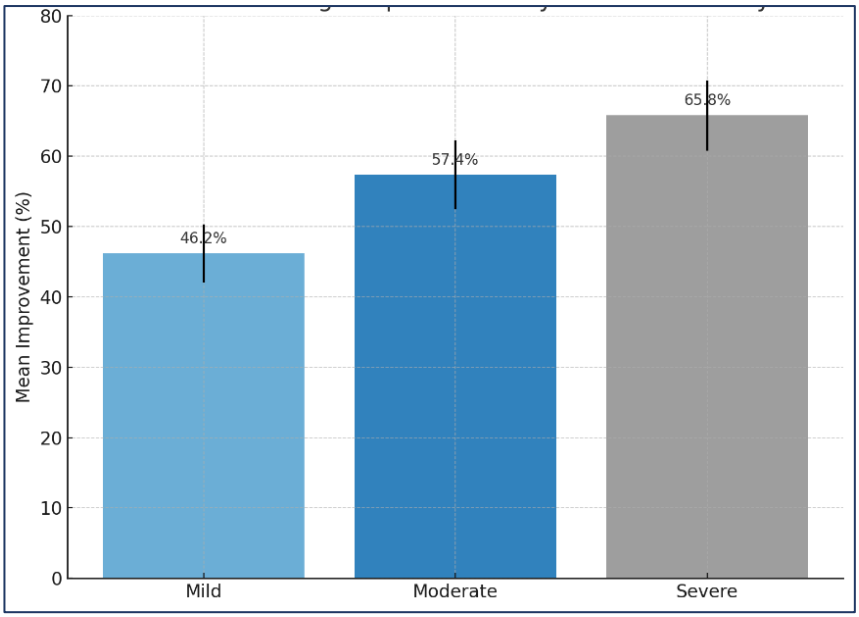

Figure 2. Mean Percentage Improvement by Psoriasis Severity

DISCUSSION

The present prospective study evaluated the therapeutic efficacy of oral vitamin D_3 supplementation in patients with chronic plaque psoriasis over a six-month period. A significant inverse correlation was established between serum vitamin D levels and Psoriasis Area and Severity Index (PASI) scores, indicating that increasing vitamin D concentrations were associated with notable clinical improvement. Serum vitamin D levels raised from 17.42 ng/mL at baseline to 40.85 ng/mL after six months, while PASI scores declined from 8.84 to 3.69 during the same period. The Pearson correlation coefficient (–0.527, $p < 0.01$) reflected a moderately strong, statistically significant relationship between improved vitamin D status and decreased disease severity.

Demographic analysis revealed a slight male predominance (52%) and a mean age of 38.7 years, with most participants falling within the 26–35 year age group, reflecting the higher prevalence of psoriasis among young to middle-aged adults. Skin type distribution showed 56% of patients with Fitzpatrick type III and 44% with type IV, yet there was no statistically significant difference in treatment response between the two groups ($p = 0.691$), indicating that skin pigmentation did not influence the efficacy of vitamin D_3 therapy. These findings are in concordance with previous studies by Disphanurat W et al. [1] and Baddour R et al. [2], who reported similar demographic distributions and outcomes.

The average BMI was 26.4 ± 4.7 kg/m², indicating a high proportion of overweight or obese patients. While elevated BMI is often associated with increased psoriasis severity, our results showed no statistically significant influence of BMI or age on treatment response (ANOVA p-values > 0.05). Notably, patients with severe baseline PASI scores showed the highest mean improvement (65.80%), followed by moderate (57.35%) and mild cases (46.20%), suggesting that those with more severe disease may experience a greater clinical response to vitamin D therapy, likely due to a larger initial inflammatory burden.

Our findings closely align with the study conducted by Baddour R et al. [2], who observed a similar decline in PASI scores (from 8.6 to 3.7) and a rise in serum vitamin D levels (from 17.26 to 40.10 ng/mL) over six months. Both studies demonstrated comparable therapeutic responses, with over 60% of patients in each cohort achieving more than 50% improvement. Furthermore, neither patient age nor skin tone significantly influenced clinical response in either study, reinforcing the universal applicability of vitamin D supplementation across diverse demographic subgroups.

When contextualized within global literature, our outcomes contrast with some earlier trials that reported minimal or no therapeutic benefit. For instance, Jarrett et al. [19] and Ingram et al. [20] used monthly doses of 100,000 IU or more, yet found limited improvement in PASI scores. Hata et al. [21] similarly reported no benefit with daily doses of 4,000 IU. These discrepancies may be attributed to subtherapeutic dosing frequencies, differences in vitamin D formulations, or variations in baseline disease severity and patient characteristics. In contrast, studies using sustained high-dose regimens such as those by Finamor et al. [5] (35,000 IU/day) and Disphanurat W et al. [1] (20,000 IU biweekly) reported significant clinical improvement, consistent with the positive outcomes in our study.

Regarding safety, our study and that of Baddour R et al. [6] observed good tolerance of vitamin D supplementation, with minor side effects such as nausea and constipation reported infrequently and no serious adverse events documented. This highlights the favorable safety profile of high-dose vitamin D when monitored appropriately.

Nevertheless, limitations persist. Both studies were limited to plaque psoriasis and lacked long-term follow-up to assess relapse or sustainability of the response. Moreover, the absence of a control group in our study restricts the ability to attribute all improvements solely to vitamin D supplementation.

In conclusion, this study, underscores the potential of high-dose oral vitamin D_3 as an effective, safe adjunctive therapy in the management of chronic plaque psoriasis. Given the observed trends and consistent outcomes, further randomized controlled trials with larger sample sizes and longer

follow-up durations are warranted to optimize dosing protocols, explore long-term safety, and expand applicability across psoriasis subtypes.

CONCLUSION

In conclusion, this study highlights the therapeutic potential of high-dose oral vitamin D_3 supplementation as a safe, well-tolerated, and effective adjunct in the management of chronic plaque psoriasis, particularly among patients with documented deficiency. The significant inverse correlation observed between serum vitamin D levels and PASI scores underscores the immunomodulatory role of vitamin D in reducing disease severity. Notably, clinical improvement was consistent across age groups, skin types, and baseline disease severities, suggesting its broad applicability. With over 90% of patients showing measurable improvement and minimal side effects, vitamin D emerges as a promising, accessible, and cost-effective therapeutic option that warrants further exploration in larger, multi-center trials and in combination with established psoriasis treatments.

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