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25-HYDROXYVITAMIN D AND SERUM CALCIUM LEVELS IN PATIENTS WITH PSORIASIS

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ABSTRACT **Background:** Psoriasis is a chronic immune-mediated inflammatory disease associated with abnormal keratinocyte proliferation and systemic inflammation. Altered vitamin D metabolism and calcium homeostasis have been implicated in its pathogenesis; however, evidence from Indian populations remains limited.**Aim:** To compare serum 25-hydroxyvitamin D and serum calcium levels between patients with psoriasis and healthy controls and to evaluate their association with disease severity.**Methods:** This hospital-based cross-sectional comparative study included 42 patients with psoriasis and 42 age- and sex-matched controls. Serum 25-hydroxyvitamin D was measured using enzyme-linked fluorescence assay (ELFA), while serum calcium was estimated by the Arsenazo III method. Disease severity was assessed using the Psoriasis Area and Severity Index (PASI). Statistical analysis was performed using SPSS version 23.0.**Results:** Patients with psoriasis had significantly lower serum 25-hydroxyvitamin D (22.08 ± 4.91 vs. 32.57 ± 1.43 ng/mL; $p < 0.0001$) and serum calcium levels (7.41 ± 0.43 vs. 8.81 ± 1.52 mg/dL; $p < 0.0001$) than controls. The mean PASI score was 18.89 ± 9.16. PASI score demonstrated a strong negative correlation with vitamin D ($r = -0.9215$; $p < 0.0001$) and serum calcium ($r = -0.7874$; $p < 0.0001$).**Conclusion:** Reduced serum vitamin D and calcium levels were significantly associated with psoriasis and increasing disease severity, suggesting their potential role as biomarkers and therapeutic targets.

KEYWORDS : 25-hydroxyvitamin D; Serum calcium; PASI; Vitamin D deficiency; Disease severity.

INTRODUCTION

Psoriasis is a chronic, immune-mediated inflammatory disorder characterized by cutaneous lesions and systemic manifestations, including psoriatic arthritis, dactylitis, enthesitis, axial spondyloarthritis, and nail involvement. It affects approximately 2–3% of the global population, with prevalence varying across different geographic regions.[1] In India, the reported prevalence ranges from 0.44% to 2.8%, with most patients presenting during the third or fourth decade of life and a higher incidence among males. Beyond its physical manifestations, psoriasis significantly impairs patients' quality of life and is associated with substantial psychosocial burden.[2] The World Health Organization has identified important gaps in psoriasis research, particularly regarding its epidemiology, pathogenesis, systemic comorbidities, and the development of effective, affordable treatment strategies suitable for diverse healthcare settings.[3]

Vitamin D, synthesized in the skin following ultraviolet B exposure, plays a key role in calcium homeostasis and exhibits immunomodulatory and anti-inflammatory effects. Altered vitamin D status has been implicated in the pathogenesis of psoriasis; however, evidence regarding the therapeutic benefits of vitamin D supplementation remains inconsistent.[4] Calcium is essential for keratinocyte proliferation and differentiation, and disturbances in calcium metabolism have been associated with disease exacerbation, particularly in pustular psoriasis and conditions such as hypoparathyroidism and pseudohypoparathyroidism.[5,6]

Despite increasing evidence supporting the involvement of vitamin D and calcium in psoriasis, data comparing their serum levels in patients with psoriasis and healthy individuals, particularly in the Indian population, remain limited. Therefore, the present study aims to assess and compare serum 25-hydroxyvitamin D and serum calcium levels between patients with psoriasis and age- and sex-matched healthy controls, and to evaluate their association with disease severity and duration.

METHODOLOGY

Study Design and Setting

The present hospital-based cross-sectional comparative study was conducted in the Department of Dermatology, Venereology and Leprosy (DVL), PES Institute of Medical Sciences and Research (PESIMSR), Kuppam, Andhra Pradesh, India for a period of 18 months.

Sampling Method

Participants were recruited using a purposive sampling technique.

Study Population and Sample Size

The study included 84 participants, comprising 42 patients clinically diagnosed with psoriasis (diseased group) and 42 age- and gender-matched individuals without psoriasis (non-diseased group) attending the dermatology outpatient department. The sample size was calculated based on a previous study by Pokharel *et al.* (2022).[7]

Eligibility Criteria

Patients were enrolled into either the psoriasis (diseased) group or the non-psoriasis (control) group based on predefined eligibility criteria.

Inclusion criteria: The diseased group comprised patients aged ≥18 years with a clinical diagnosis of psoriasis. The non-diseased group included age- and sex-matched individuals aged ≥18 years attending the dermatology outpatient department with non-psoriatic skin disorders.

Exclusion criteria: Patients with psoriasis receiving systemic therapy or who had received systemic therapy within the preceding one month were excluded. Participants from both groups were excluded if they had chronic inflammatory or autoimmune disorders known to affect serum 25-hydroxyvitamin D or calcium levels, had received vitamin D or calcium supplementation within the previous three months, or were pregnant or lactating women.

Data Collection Procedure

After obtaining approval from the Institutional Human Ethics Committee (IHEC), written informed consent was obtained from all participants prior to enrollment. A detailed clinical history was recorded, followed by general, systemic, and dermatological examinations. The Psoriasis Area and Severity Index (PASI) score was assessed in all patients with psoriasis. Skin biopsy was performed in selected cases where the diagnosis was clinically uncertain.

Laboratory Investigations

Venous blood samples were collected from all participants for biochemical analysis. Serum calcium levels were estimated using the Arsenazo III method on a Vitros analyzer, while serum 25-hydroxyvitamin D levels were measured using the enzyme-linked fluorescence assay (ELFA) technique.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 23.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were expressed as frequencies and percentages for categorical variables and as mean ± standard deviation for continuous variables. Comparisons between groups were performed using the independent *t*-test for continuous variables and the Chi-square test for categorical variables. Correlation of serum 25-hydroxyvitamin D and calcium levels with disease severity and duration was assessed using appropriate statistical methods. A *p*-value <0.05 was considered statistically significant.

RESULTS

A total of 84 participants were enrolled in the study, comprising 42 patients with clinically diagnosed psoriasis (case group) and 42 age- and sex-matched individuals without psoriasis (control group). Among the patients with psoriasis, the mean Psoriasis Area and Severity Index (PASI) score was 18.89 ± 9.16, with values ranging from 6.4 to 44.8, indicating that the study population included patients with varying degrees of disease severity.

The mean age of patients with psoriasis was 39.26 ± 12.04 years, compared with 41.74 ± 11.10 years among controls. The difference in mean age between the two groups was not statistically significant ($t = -0.98$, $p = 0.330$). Similarly, the distribution of gender was comparable between the groups, with females constituting 61.9% of the psoriasis group and 50.0% of the control group ($\chi^2 = 1.21$, $p = 0.272$). No statistically significant differences were observed with respect to educational status, occupation, socioeconomic status, place of residence, family type, or marital status (all $p > 0.05$), indicating that the study groups were well matched with regard to baseline demographic characteristics (Table 1).

Comparison of biochemical parameters revealed that patients with psoriasis had significantly lower serum 25-hydroxyvitamin D levels than the control group. The mean serum 25-hydroxyvitamin D concentration was 22.08 ± 4.91 ng/mL in the psoriasis group compared with 32.57 ± 1.43 ng/mL among controls, and the difference was statistically highly significant ($t = -13.29$, $p < 0.0001$). Similarly, the mean serum calcium level was significantly lower in patients with psoriasis (7.41 ± 0.43 mg/dL) than in controls (8.81 ± 1.52 mg/dL) ($t = -5.74$, $p < 0.0001$) (Table 2).

Correlation analysis demonstrated a strong inverse relationship between disease severity and serum 25-hydroxyvitamin D levels. PASI score showed a statistically highly significant negative correlation with serum 25-hydroxyvitamin D levels ($r = -0.9215$, $p < 0.0001$), indicating that increasing disease severity was associated with lower vitamin D levels (Figure 1). Likewise, PASI score exhibited a significant negative correlation with serum calcium levels ($r = -0.7874$, $p < 0.0001$), suggesting that lower serum calcium levels were associated with more severe psoriasis (Figure 2).

Simple linear regression analysis further confirmed these findings. Serum 25-hydroxyvitamin D demonstrated a significant inverse association with PASI score ($\beta = -0.4944$, SE = 0.0329, $t = -15.01$, $p < 0.0001$), indicating that each one-unit increase in PASI score was associated with an estimated decrease of 0.494 ng/mL in serum 25-hydroxyvitamin D concentration. Similarly, serum calcium levels showed a significant negative association with PASI score ($\beta = -0.0370$, SE = 0.0046, $t = -8.08$, $p < 0.0001$), with each one-unit increase in PASI score corresponding to an estimated decrease of 0.037 mg/dL in serum calcium concentration (Table 3).

Table 1: Baseline demographic characteristics of the study participants

Variable	Category	Psoriasis (n = 42)	Controls (n = 42)	Test statistic	P value
Age (years)¶	Mean ± SD	39.26 ± 12.04	41.74 ± 11.10	t = -0.98	0.330
Gender	Male	16 (38.1)	21 (50.0)	$\chi^2 = 1.21$	0.272
	Female	26 (61.9)	21 (50.0)		
Education	Illiterate	12 (28.6)	13 (31.0)	$\chi^2 = 0.28$	0.964
	Primary school	11 (26.2)	9 (21.4)		
	High school	12 (28.6)	13 (31.0)		
	Intermediate/Diploma	7 (16.6)	7 (16.6)		
Occupation	Unemployed	1 (2.3)	4 (9.6)	$\chi^2 = 3.93$	0.269
	Unskilled	18 (42.9)	11 (26.2)		
	Semi-skilled	18 (42.9)	20 (47.6)		
	Skilled	5 (11.9)	7 (16.6)		
Socioeconomic status	Lower	26 (61.9)	28 (66.7)	$\chi^2 = 0.61$	0.738
	Lower middle	3 (7.1)	4 (9.5)		
	Upper lower	13 (31.0)	10 (23.8)		
Residence	Rural	28 (66.7)	24 (57.1)	$\chi^2 = 0.81$	0.369
	Semi-urban	14 (33.3)	18 (42.9)		
Family type	Nuclear	33 (78.6)	34 (81.0)	$\chi^2 = 0.07$	0.786
	Joint	9 (21.4)	8 (19.0)		
Marital status	Married	33 (78.6)	34 (81.0)	$\chi^2 = 4.95$	0.084
	Unmarried	8 (19.0)	3 (7.1)		
	Widow/Div	1 (2.4)	5 (11.9)		

Independent t test; Chi-square; P < 0.05 was considered statistically significant.

Table 2: Comparison of serum 25-hydroxyvitamin D and serum calcium levels between psoriasis patients and controls

Parameter	Psoriasis (n=42) Mean ± SD	Controls (n=42) Mean ± SD	Test statistic	P value
Serum 25-hydroxyvitamin D (ng/mL)	22.08 ± 4.91	32.57 ± 1.43	t = -13.29	<0.0001**
Serum calcium (mg/dL)	7.41 ± 0.43	8.81 ± 1.52	t = -5.74	<0.0001**

Independent t test; P < 0.05 was considered statistically significant.

Table 3: Linear regression analysis of serum 25-hydroxyvitamin D and serum calcium levels with PASI score

Outcome variable	Regression coefficient (β)	Standard error	t value	P value
Serum 25-hydroxyvitamin D (ng/mL)	-0.4944	0.0329	-15.01	<0.0001**
Serum calcium (mg/dL)	-0.0370	0.0046	-8.08	<0.0001

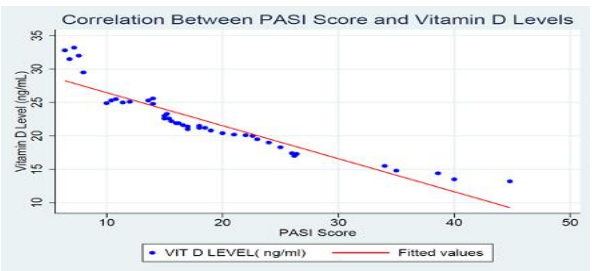

Figure 1: Correlation of PASI score with serum 25-hydroxyvitamin D in psoriasis patients

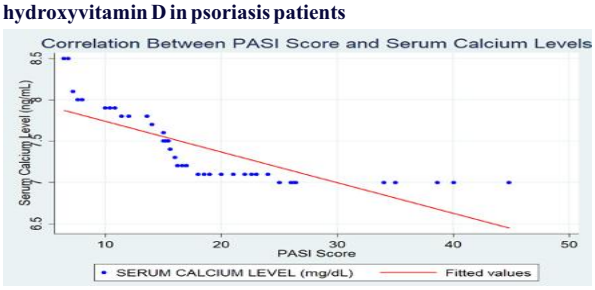

Figure 2: Correlation of PASI score with serum calcium levels in psoriasis patients

DISCUSSION

The present hospital-based comparative study evaluated serum 25-hydroxyvitamin D and serum calcium levels in patients with psoriasis and age- and sex-matched healthy controls and examined their association with disease severity. The demographic characteristics of the study population were comparable with respect to age, gender, educational status, occupation, socioeconomic status, residence, family type, and marital status. The absence of statistically significant differences in these baseline variables suggested that the two groups were well matched, thereby minimizing the influence of potential confounding factors on the study outcomes.

The mean PASI score among patients with psoriasis was 18.89 ± 9.16, indicating that the study population predominantly had moderate-to-severe disease. Serum 25-hydroxyvitamin D levels were significantly lower in patients with psoriasis than in healthy controls (22.08 ± 4.91 ng/mL vs. 32.57 ± 1.43 ng/mL; $p < 0.0001$). Furthermore, a strong negative correlation was observed between serum vitamin D levels and PASI score, indicating that vitamin D levels progressively declined with increasing disease severity. Linear regression analysis further demonstrated that each one-unit increase in PASI score was associated with an estimated reduction of 0.49 ng/mL in serum vitamin D, emphasizing the close relationship between vitamin D deficiency and psoriasis severity.

The findings of the present study were consistent with those reported by Orgaz-Molina *et al.*, Gisondi *et al.*, Ricceri *et al.*, and Bhat *et al.*, who also demonstrated significantly lower serum vitamin D levels in patients with psoriasis and an inverse association with disease severity.[8-11] Conversely, Zuchi *et al.*, Wilson *et al.*, Darjani *et al.*, and Maleki *et al.* did not observe statistically significant differences in vitamin D levels between patients and controls, although they reported a high prevalence of vitamin D insufficiency among patients with psoriasis.[12-15] These discrepancies may be explained by differences in study design, sample size, geographical location, disease severity, seasonal variation, and sunlight exposure. The molecular findings reported by Cubillos and Norgauer further supported the biological plausibility of the present results by demonstrating altered expression of vitamin D-metabolizing enzymes and calcium-regulating proteins in psoriatic skin, leading to impaired keratinocyte differentiation and disturbed calcium homeostasis.[16]In addition, Debnath *et al.* demonstrated significant clinical improvement following oral vitamin D supplementation, while Saraceno *et al.* highlighted the beneficial effects of topical calcitriol in reducing keratinocyte proliferation and promoting epidermal differentiation, thereby supporting the therapeutic importance of vitamin D in psoriasis management.[17,18]

The present study also demonstrated significantly lower serum calcium levels in patients with psoriasis than in healthy controls (7.41 ± 0.43 mg/dL vs. 8.81 ± 1.52 mg/dL; $p < 0.0001$). Serum calcium levels showed a strong negative correlation with PASI score, and regression analysis confirmed that each unit increase in PASI score was associated with a reduction of 0.037 mg/dL in serum calcium. These findings suggested that hypocalcemia was associated with increasing disease severity and may contribute to the abnormal keratinocyte proliferation and differentiation characteristic of psoriasis.

The observed association between serum calcium and psoriasis severity was in agreement with the findings of Ambike *et al.*, Maheswari and Dutta, Bijina *et al.*, and Bari *et al.*, who reported significant inverse correlations between serum calcium levels and PASI score.[19-22] Although Chaudhari and Rathi reported reduced serum calcium levels without a significant association with disease severity, the present findings suggested that serum calcium may serve as a useful biochemical marker reflecting disease activity.[23] Similarly, studies by Family *et al.*, Qadim *et al.*, and Baral *et al.* also demonstrated a higher prevalence of hypocalcemia among patients with psoriasis, supporting the findings of the present study.[24-26] Furthermore, Mehta *et al.* emphasized the importance of evaluating calcium metabolism along with vitamin D and parathyroid hormone in psoriasis, highlighting the need for further research exploring these interconnected biochemical pathways.[27]

The significant inverse correlations observed between PASI score and both serum vitamin D and serum calcium levels indicated that these biochemical parameters were closely associated with disease severity. The regression models further confirmed PASI score as a significant predictor of serum vitamin D and calcium levels, suggesting that increasing disease severity was accompanied by progressive deterioration in these biochemical markers. These findings support the hypothesis that disturbances in vitamin D and calcium metabolism play an important role in the pathophysiology of psoriasis and may serve as potential biomarkers for disease activity.

Overall, the findings of the present study supported the growing body of evidence demonstrating that patients with psoriasis have significantly lower serum vitamin D and calcium levels than healthy individuals and that these deficiencies become more pronounced with increasing disease severity. Routine assessment of serum 25-hydroxyvitamin D and calcium levels may therefore aid in identifying patients at risk of deficiency and could have potential diagnostic, prognostic, and therapeutic implications. However, further large-scale prospective studies are required to establish causality and to determine whether correction of these deficiencies can improve long-term clinical outcomes in patients with psoriasis.

The present study was strengthened by its comparative design with age- and sex-matched controls, standardized assessment of disease severity using the Psoriasis Area and Severity Index (PASI), and simultaneous evaluation of serum 25-hydroxyvitamin D and serum calcium levels. Nevertheless, the study was limited by its relatively small sample size, single-center hospital-based setting, and cross-sectional design, which precluded causal inference. In addition, potential confounding factors such as seasonal variation, sunlight exposure, dietary intake, body mass index, parathyroid hormone levels, and inflammatory biomarkers were not assessed. Therefore, future multicentric prospective studies with larger sample sizes and longer follow-up are recommended to validate these findings, evaluate additional biochemical determinants, and investigate whether vitamin D and calcium supplementation can improve disease severity and clinical outcomes in patients with psoriasis.

CONCLUSION

The present study demonstrated that patients with psoriasis had significantly lower serum 25-hydroxyvitamin D and serum calcium levels than age- and sex-matched healthy controls. Both biochemical parameters exhibited a strong inverse association with disease severity, as measured by the Psoriasis Area and Severity Index (PASI), indicating that lower vitamin D and calcium levels were associated with more severe disease. Linear regression analysis further confirmed PASI score as a significant predictor of serum vitamin D and calcium levels, highlighting the close relationship between these biochemical markers and psoriasis severity.

These findings suggest that disturbances in vitamin D metabolism and calcium homeostasis may contribute to the pathophysiology of psoriasis and could serve as useful biomarkers of disease activity. Routine assessment of serum 25-hydroxyvitamin D and calcium levels may facilitate the early identification of deficiencies, particularly in patients with moderate-to-severe psoriasis, and may have potential diagnostic and therapeutic implications. However, owing to the cross-sectional design and relatively small sample size, causal inferences could not be established. Further large-scale, multicentric prospective and interventional studies are warranted to clarify the causal relationship between these biochemical abnormalities and psoriasis and to determine whether correction of vitamin D and calcium deficiencies can improve disease outcomes.

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