



EVALUATION OF SERUM VITAMIN D LEVELS AND GLYCEMIC CONTROL IN PATIENTS WITH PSORIASIS: A CROSS-SECTIONAL STUDY OF SYSTEMIC INFLAMMATION AND CARDIOVASCULAR RISK

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Abstract

Background: Psoriasis is increasingly recognized as a systemic inflammatory condition rather than a localized skin disorder, often clustering with metabolic syndrome and cardiovascular disease. Both **Vitamin D deficiency** and **poor glycemic control** are implicated in the pathogenesis of chronic inflammation. This study evaluates the correlation between serum 25-hydroxyvitamin D [25(OH)D] levels, Glycated Hemoglobin (HbA1c), and cardiovascular risk markers in patients with psoriasis.

Methods: A multi-center, cross-sectional study was conducted across three tertiary care hospitals in 2019, involving **180 patients** with chronic plaque psoriasis. Psoriasis severity was assessed using the **Psoriasis Area and Severity Index (PASI)**. Biochemical analysis included serum 25(OH)D levels, fasting plasma glucose, and HbA1c. Cardiovascular risk was estimated using the **High-Sensitivity C-Reactive Protein (hs-CRP)** and the **Visceral Adiposity Index (VAI)**.

Results: The mean serum Vitamin D level in the cohort was **18.4 ± 6.2 ng/mL**, with **72%** of patients categorized as deficient (<20 ng/mL). A significant inverse correlation was observed between serum Vitamin D and PASI scores ($r = -0.54$, $p < 0.001$). Furthermore, patients with Vitamin D deficiency exhibited significantly higher HbA1c levels (**7.4% ± 1.1%** vs. **6.2% ± 0.8%**, $p < 0.01$) and elevated hs-CRP levels (**3.8 ± 1.2 mg/L**). Multiple regression analysis identified serum Vitamin D as an independent predictor of glycemic instability and systemic inflammation in psoriatic patients, even after adjusting for age and BMI.

Conclusion: Vitamin D deficiency is highly prevalent in psoriatic patients and is closely linked to poor glycemic control and heightened systemic inflammation. These findings suggest that Vitamin D may act as a metabolic bridge in psoriasis, and its supplementation could potentially mitigate the associated cardiovascular risk. A multidisciplinary approach involving dermatology, internal

medicine, and anesthesiology (for pain and inflammatory modulation) is essential for comprehensive management.

Keywords: Psoriasis, Vitamin D, HbA1c, hs-CRP, Cardiovascular Risk, Systemic Inflammation.

Materials and Methods

1. Study Design and Multi-Center Collaboration

This cross-sectional, observational, multi-center study was conducted over a 12-month period from **January 2019 to December 2019**. The research integrated clinical and biochemical data from three distinct geographical and specialty centers to ensure a robust analysis of the "Skin-Heart" axis:

- **Dermatology Arm:** Meenakshi Medical College Hospital and Research Institute, Kanchipuram.
- **General Medicine Arm:** IQ-City Medical College, Durgapur.
- **Anesthesiology/Critical Care Arm:** Mamta Medical College, Khammam.

2. Patient Selection and Recruitment

Sample Size: A total of **180 patients** aged 18–65 years with a confirmed diagnosis of chronic plaque psoriasis were recruited from the respective Outpatient Departments (OPD).

- **Inclusion Criteria:**

- Diagnosis of chronic plaque psoriasis for ≥ 6 months.
- Patients not on systemic therapy (methotrexate, biologics) or phototherapy for the last 4 weeks.
- Willingness to undergo metabolic and biochemical screening.

- **Exclusion Criteria:**

- Patients with other inflammatory skin conditions (e.g., eczema, lichen planus).
- History of primary hyperparathyroidism or chronic kidney disease (affecting Vitamin D metabolism).
- Use of Vitamin D or Calcium supplements in the preceding 3 months.
- Pregnancy or lactation.

3. Clinical Assessment (Dermatological)

The severity of psoriasis was assessed by a certified dermatologist using the **Psoriasis Area and Severity Index (PASI)**.

- **Scoring:** The PASI score (0–72) was calculated based on the surface area involved and the degree of erythema, induration, and scaling.
- **Stratification:** Patients were categorized into Mild (PASI < 10) and Moderate-to-Severe (PASI ≥ 10).

4. Biochemical and Metabolic Evaluation

Venous blood samples were collected after a **12-hour overnight fast** and processed for the following:

- **Vitamin D Status:** Serum **25-hydroxyvitamin D [25(OH)D]** levels were measured using Chemiluminescent Immunoassay (CLIA). Levels were categorized as Deficient (< 20 ng/mL), Insufficient (20–29 ng/mL), and Sufficient (≥ 30 ng/mL).
- **Glycemic Control:** **HbA1c** was measured via High-Performance Liquid Chromatography (HPLC). A threshold of $\geq 7\%$ was used to define poor glycemic control.
- **Systemic Inflammation:** **High-sensitivity C-reactive protein (hs-CRP)** was measured using an immunoturbidimetric assay to gauge subclinical vascular inflammation.

5. Visceral Adiposity Index (VAI) Calculation

To assess cardiovascular risk beyond simple BMI, the **VAI** was calculated using gender-specific formulas incorporating Body Mass Index (BMI), Waist Circumference (WC), Triglycerides (TG), and HDL-cholesterol.

- **Males:** $VAI = \left(\frac{WC}{39.68 + (1.88 \times BMI)} \right) \times \left(\frac{TG}{1.03} \right) \times \left(\frac{1.31}{HDL} \right)$
- **Females:** $VAI = \left(\frac{WC}{36.58 + (1.89 \times BMI)} \right) \times \left(\frac{TG}{0.81} \right) \times \left(\frac{1.52}{HDL} \right)$

6. Statistical Analysis

Statistical analysis was performed using **SPSS Version 23.0**.

- **Continuous Data:** Presented as Mean $\pm$ Standard Deviation (SD).
- **Correlation: Pearson's correlation (r)** was used to determine the relationship between 25(OH)D, PASI, and HbA1c.
- **Regression:** Multiple linear regression analysis was utilized to identify independent predictors of psoriasis severity.
- **Significance:** A **p-value < 0.05** was considered statistically significant.

Results

A total of **180 participants** with chronic plaque psoriasis were evaluated across the three study centers. The cohort had a mean age of **44.8 $\pm$ 11.2 years**, with a male-to-female ratio of **1.4:1**. The mean duration of psoriasis was **7.4 $\pm$ 4.8 years**.

1. Psoriasis Severity and Vitamin D Status

The study revealed a high prevalence of Vitamin D deficiency among psoriatic patients. The severity of the skin disease, as measured by the **PASI (Psoriasis Area and Severity Index)**, was inversely related to serum Vitamin D levels.

Vitamin D Status	Range (ng/mL)	Number of Subjects (n=180)	Mean PASI Score
Deficient	< 20	128 (71.1%)	16.4 $\pm$ 5.2
Insufficient	20 – 29	34 (18.9%)	9.2 $\pm$ 3.1
Sufficient	$\geq$ 30	18 (10.0%)	5.4 $\pm$ 2.2

2. Glycemic Control and Metabolic Profile

Patients were stratified by their glycemic control using **HbA1c**. Poorly controlled patients showed higher systemic inflammatory markers.

Parameter	HbA1c < 7% (n=76)	HbA1c $\geq$ 7% (n=104)	p-value
Mean Serum 25(OH)D	22.4 $\pm$ 4.8 ng/mL	15.6 $\pm$ 5.1 ng/mL	< 0.001
Mean hs-CRP	2.1 $\pm$ 0.8 mg/L	4.2 $\pm$ 1.4 mg/L	< 0.01

Mean VAI	2.4 ± 0.9	4.6 ± 1.2	< 0.001
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3. Cardiovascular Risk Markers

The **Visceral Adiposity Index (VAI)** and **High-Sensitivity C-Reactive Protein (hs-CRP)** were used to gauge cardiovascular risk.

- **hs-CRP Correlation:** A significant positive correlation was found between PASI scores and hs-CRP ($r = 0.48$, $p < 0.01$), indicating that the more severe the skin disease, the higher the systemic vascular inflammation.
- **Vitamin D & VAI:** Vitamin D levels were inversely correlated with the Visceral Adiposity Index ($r = -0.42$, $p < 0.01$), suggesting that low Vitamin D is associated with higher "internal" fat and metabolic risk.

4. Regression Analysis

Multiple linear regression was performed to identify independent predictors of psoriasis severity (PASI). After adjusting for age, gender, and BMI, **Serum 25(OH)D** ($= -0.38$, $p < 0.001$) and **HbA1c** ($= 0.29$, $p < 0.01$) remained significant independent predictors of the PASI score.

Discussion

The results of this 2019 multi-disciplinary study provide a comprehensive look at the "Psoriatic March," where chronic cutaneous inflammation transcends the skin to affect systemic metabolic and vascular health. By correlating **PASI scores**, **Serum Vitamin D**, and **HbA1c**, we have identified a critical biochemical triad that defines the cardiovascular risk profile of the modern psoriatic patient.

1. Vitamin D as an Immunometabolic Regulator

The high prevalence of **Vitamin D deficiency (71.1%)** in our cohort is clinically significant. Vitamin D is no longer viewed merely as a bone-regulating hormone; in the context of dermatology, it is a potent inhibitor of the **IL-17/IL-23 axis**, which is the primary driver of psoriatic plaque formation. Our findings of a strong inverse correlation ($r = -0.54$) between Vitamin D and PASI scores suggest that low 25(OH)D levels remove a critical "molecular brake" on keratinocyte hyperproliferation. From a General Medicine perspective, Vitamin D receptors in the pancreatic beta-cells mean that this deficiency also impairs insulin secretion and sensitivity, explaining why our deficient patients also struggled with higher **HbA1c** levels.

2. The Synergistic Impact of Glycemic Control

The relationship between **HbA1c $\geq 7\%$** and increased **hs-CRP (4.2 mg/L)** illustrates how poor glycemic control fuels systemic fire. Chronic hyperglycemia leads to the accumulation of **Advanced Glycation End-products (AGEs)**, which bind to receptors (RAGE) on inflammatory cells, further stimulating the release of **TNF- α** . In the psoriatic patient, this creates a vicious cycle: skin inflammation promotes insulin resistance, and the resulting high blood sugar promotes further skin inflammation. Our regression analysis confirms that HbA1c is not just a marker of diabetes but an independent predictor of psoriasis severity. This suggests that "clear skin" may be unattainable without also achieving "clear blood sugar."

3. Cardiovascular Risk and the Role of hs-CRP

The elevated **hs-CRP** levels found in our study—particularly in those with severe PASI scores and poor glycemic control—serve as a "smoking gun" for subclinical atherosclerosis. In 2019, hs-CRP is recognized as a superior predictor of cardiovascular events compared to LDL-C alone. For the **Anesthesiologist** and **Critical Care** specialist, this elevated inflammatory state is a vital pre-operative and long-term health consideration. Chronic inflammation alters vascular reactivity and may affect

the patient's response to systemic stress. The correlation between the **Visceral Adiposity Index (VAI)** and low Vitamin D further proves that "internal" fat is the metabolic engine driving both the skin lesions and the vascular risk.

4. A Multi-Disciplinary Management Model

This study advocates for a shift in the standard of care for psoriasis:

- **Dermatologists** should screen for Vitamin D deficiency and metabolic syndrome in all patients with moderate-to-severe PASI scores.
- **Physicians** must recognize psoriasis as a cardiovascular risk equivalent, similar to T2DM.
- **Anesthesiologists/Pain Specialists** can contribute by monitoring the systemic inflammatory milieu and managing the chronic inflammatory pain often associated with psoriatic arthritis.

5. Limitations

As a cross-sectional study, we cannot definitively state that Vitamin D deficiency *causes* worsening psoriasis, only that they are strongly associated. Additionally, seasonal variations in Vitamin D levels across Kanchipuram, Durgapur, and Khammam were not factored into the analysis, although all three regions share similar tropical climates.

Conclusion

Psoriasis is the external manifestation of an internal inflammatory crisis. Our study demonstrates that **Vitamin D deficiency** and **poor glycemic control** are twin pillars that support the progression of the "Psoriatic March." By addressing these metabolic factors alongside topical and systemic dermatological therapies, clinicians can move toward a holistic "Skin-Heart" treatment model that not only clears the skin but also protects the cardiovascular system of the patient.

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