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Original Research Article

Study of Vitamin D, Prolactin, C - reactive protein and Adenosine Deaminase Levels in Psoriasis Patients

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Abstract

Introduction: Psoriasis is a chronic, immune-mediated inflammatory skin disease characterized by dysregulated keratinocyte proliferation and activation of the IL-23/Th17 immune pathway. Beyond cutaneous involvement, psoriasis is increasingly recognized as a systemic inflammatory disorder associated with metabolic and cardiovascular comorbidities. Alterations in serum biomarkers such as Vitamin D, prolactin, C-reactive protein (CRP), and adenosine deaminase (ADA) have been implicated in disease pathogenesis and may reflect disease activity.

Aim: To evaluate and compare serum Vitamin D, prolactin, CRP, and ADA levels in patients with psoriasis and healthy controls, and to assess their association with disease severity.

Methodology: This hospital-based case-control study was conducted in the Department of Biochemistry in collaboration with the Department of Dermatology at Jhalawar Medical College and S.R.G. Hospital, Jhalawar. Clinically diagnosed psoriasis patients and age- and sex-matched healthy controls were enrolled after obtaining informed consent. Disease severity was assessed using the Psoriasis Area and Severity Index (PASI). Venous blood samples were collected for estimation of serum Vitamin D, prolactin, CRP, and ADA using standard laboratory methods. The biochemical parameters were compared between cases and controls, and their correlation with PASI scores was analyzed using appropriate statistical tests.

Results: A total of 120 participants were included in the study, comprising 60 psoriasis patients and 60 age- and sex-matched healthy controls. The mean age and BMI were comparable between the two groups, indicating appropriate matching. Plaque psoriasis was the predominant clinical type (83.33%), with most patients having moderate disease severity (51.67%) and a mean PASI score of 13.23 ± 6.98. Serum Vitamin D levels were significantly lower in psoriasis patients (16.66 ± 4.53 ng/mL) compared to controls (29.87 ± 7.82 ng/mL, $p<0.001$). In contrast, serum prolactin (13.85 ± 6.21 vs. 8.22 ± 2.89 ng/mL), CRP (11.06 ± 5.20 vs. 3.29 ± 1.39 mg/L), and ADA (22.71 ± 5.99 vs. 11.50 ± 2.83 U/L) were significantly elevated in cases (all $p<0.001$).

Conclusion: These findings indicate that psoriasis is associated with Vitamin D deficiency, increased systemic inflammation, and enhanced T-cell-mediated immune activation. Combined assessment of these biomarkers may provide a valuable adjunct for evaluating disease activity, monitoring treatment response, and identifying patients at greater risk of severe disease and systemic complications.

Keywords: Psoriasis, Vitamin D, 25-Hydroxyvitamin D [25(OH)D], Prolactin, C-Reactive Protein (CRP), Adenosine Deaminase (ADA), Biomarkers, Psoriasis Area and Severity Index (PASI), Systemic Inflammation.

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Introduction

Psoriasis is a chronic, relapsing inflammatory disorder of the skin resulting from immune dysregulation and abnormal epidermal proliferation. It affects nearly 2–3% of the global population, while the prevalence in India varies between 0.44% and 2.8%. Although traditionally regarded as a dermatological disease, current evidence identifies psoriasis as a multisystem inflammatory condition associated with metabolic syndrome, cardiovascular disease, diabetes mellitus, psoriatic arthritis, and psychological disorders. Consequently, the disease contributes substantially to morbidity and reduced quality of life. The development of psoriasis is influenced by a combination of genetic predisposition, environmental factors, and immune dysfunction.

The IL-23/Th17 pathway plays a central role by promoting activation of T lymphocytes and release of inflammatory cytokines such as TNF-α, IL-17, and IL-22. These mediators stimulate excessive keratinocyte proliferation, abnormal epidermal differentiation, angiogenesis, and persistent inflammation, producing the characteristic erythematous, scaly plaques of psoriasis. Although clinical severity is commonly evaluated using the Psoriasis Area and Severity Index (PASI), biochemical markers may provide additional objective information regarding disease activity and systemic involvement.

Recent studies have emphasized the importance of several serum biomarkers in understanding psoriasis. Vitamin D possesses immunoregulatory properties that suppress pro-inflammatory immune responses while promoting immune tolerance. Deficiency of Vitamin D has been associated with increased disease severity. Prolactin, beyond its endocrine function, acts as an immunomodulatory hormone capable of enhancing keratinocyte proliferation and T-cell-mediated inflammation. C-reactive protein (CRP) is a well-established marker of systemic inflammation and reflects the inflammatory burden associated with psoriasis. Adenosine deaminase (ADA), an enzyme involved in purine metabolism and lymphocyte activation, is considered an indicator of cellular immune activity and has been reported to be elevated in patients with psoriasis.

Although individual associations of these biomarkers with psoriasis have been reported, studies evaluating Vitamin D, prolactin, CRP, and ADA simultaneously in the same patient population are limited, particularly in the Indian setting.

Therefore, the present case-control study was undertaken at Jhalawar Medical College and S.R.G. Hospital, Jhalawar, to compare the serum levels of these biomarkers between psoriasis patients and healthy controls and to assess their potential value in understanding disease pathogenesis, evaluating disease severity, and supporting future therapeutic monitoring.

Aim: To evaluate and compare the serum levels of Vitamin D, Prolactin, C-Reactive Protein (CRP), and Adenosine Deaminase (ADA)and to assess their association with disease severity in patients with psoriasis and age- and sex-matched healthy controls at a tertiary care hospital–Jhalawar Medical College and S.R.G. Hospital, Jhalawar.

Objectives

1. To estimate and compare the serum Vitamin D level in psoriasis patients and healthy controls.
2. To estimate and compare the serum Prolactin levels in psoriasis patients and healthy controls.
3. To estimate and compare the serum C - reactive protein (CRP) levels in psoriasis patients and healthy controls.
4. To estimate and compare the serum Adenosine Deaminase (ADA) levels in psoriasis patients and healthy controls.
5. To correlate the levels of these biochemical parameters with disease severity as assessed by the Psoriasis Area and Severity Index (PASI) score.

Methodology

This investigation was designed as a hospital-based case-control study and conducted jointly by the Department of Biochemistry and the Department of Dermatology, Venereology and Leprosy at Jhalawar Medical College and S.R.G. Hospital, Jhalawar, Rajasthan. The study was carried out over a one-year period after obtaining approval from the Institutional Ethics Committee. All participants were enrolled only after providing written informed consent, and confidentiality was maintained throughout the study.

The study included 120 participants, comprising 60 clinically diagnosed, newly detected psoriasis patients and 60 apparently healthy age- and sex-matched controls between 30 and 70 years of age. Individuals with disorders or medications that could influence Vitamin D, prolactin, CRP, or ADA levels, including pregnancy, chronic infections, renal disease, thyroid disorders, pituitary disease, polycystic ovarian syndrome, and hormone-altering drugs, were excluded to minimize potential bias.

Detailed demographic information, medical history, clinical findings, and disease-related characteristics were recorded using a standardized case record form. Psoriasis severity was assessed by a dermatologist using the Psoriasis Area and Severity Index (PASI), and patients were classified into mild, moderate, or severe disease categories according to PASI scores.

A 10 mL fasting venous blood sample was collected from each participant between 8:00 and 10:00 AM under aseptic conditions to minimize biological variation, particularly in prolactin estimation. After centrifugation, serum and plasma samples were processed and stored until biochemical analysis. Serum 25-hydroxy Vitamin D and prolactin concentrations were measured using Electrochemiluminescence Immunoassay (ECLIA). Plasma C-reactive protein (CRP) was estimated by the immunoturbidimetric method, whereas serum adenosine deaminase (ADA) activity was determined using the Galanti and Giusti colorimetric method. Statistical analysis was performed using SPSS software. Appropriate descriptive and inferential statistical tests, including

Student's t-test, Chi-square test, Pearson's correlation, and one-way ANOVA, were applied, with a p-value <0.05 considered statistically significant.

Results

A total of 120 participants were enrolled in this hospital-based case-control study, including 60 newly diagnosed patients with psoriasis and 60 age- and sex-matched healthy controls. The two groups were comparable with respect to age and gender, thereby minimizing demographic bias. The mean age of psoriasis patients was 44.87 ± 8.41 years, and most participants belonged to the 40–49-year age group. Plaque psoriasis was the predominant clinical subtype, accounting for 83.33% of cases, while guttate and inverse psoriasis were less common. The mean PASI score was 13.23 ± 6.98, indicating that the majority of patients had moderate disease severity (51.67%), followed by mild (31.67%) and severe disease (16.67%). Nail involvement was observed in 35% of patients, whereas 16.67% had clinical evidence of psoriatic arthritis.

Comparison of biochemical parameters revealed significant differences between psoriasis patients and healthy controls. The mean serum Vitamin D concentration was significantly lower in cases (16.66 ± 4.53 ng/mL) than in controls (29.87 ± 7.82 ng/mL, p<0.001). In contrast, serum prolactin (13.85 ± 6.21 vs. 8.22 ± 2.89 ng/mL), CRP (11.06 ± 5.20 vs. 3.29 ± 1.39 mg/L), and ADA (22.71 ± 5.99 vs. 11.50 ± 2.83 U/L) were significantly higher among psoriasis patients (all p<0.001). These findings indicate the presence of altered immune regulation, persistent systemic inflammation, and enhanced cellular immune activation in psoriasis.

Analysis of biomarker levels according to disease severity demonstrated that CRP increased significantly with increasing PASI scores, showing the strongest association with disease activity (ANOVA F = 14.64, p < 0.001). Although serum prolactin and ADA showed increasing trends and Vitamin D showed lower levels across more severe disease categories, these differences did not achieve statistical significance. Pearson's correlation analysis further confirmed a strong positive correlation between CRP and PASI score (r = 0.6349, p < 0.001), whereas Vitamin D, prolactin, and ADA exhibited weak, non-significant correlations with disease severity.

Table 1: Consolidated Summary of All Primary Biochemical Parameters

Biomarker	Cases(n=60) Mean ± SD	Controls(n=60) Mean ± SD	t-value	p-value	Sig.	Direction
Vitamin D (ng/mL)	16.66±4.53	29.87±7.82	11.23	**<0.001**	**HS**	↓ Decreased
Prolactin (ng/mL)	13.85±6.21	8.22±2.89	6.32	**<0.001**	**HS**	↑ Increased
CRP(mg/dl)	11.06±5.20	3.29±1.39	11.09	**<0.001**	**HS**	↑ Increased
ADA(U/L)	22.71±5.99	11.50±2.83	12.98	**<0.001**	**HS**	↑ Increased

Table 2: Correlation of Biochemical Parameters with PASI Score (Pearson's r)

Parameter	Pearson's r	p-value	Sig.	Interpretation
Vitamin D vs PASI	0.0316	p=0.810	NS	Very WeakPositive
Prolactin vs PASI	0.2174	p=0.095	NS	Weak Positive
CRP vs prolactin	0.6349	**p<0.001**	**HS**	Strong Positive
ADA vs PASI	0.153	p=0.243	NS	Weak positive

Evaluation of Vitamin D status showed that none of the psoriasis patients had sufficient Vitamin D levels.

More than half (56.67%) were Vitamin D deficient, 28.33% were insufficient, and 15% had severe deficiency, while nearly half of the healthy controls had adequate Vitamin D status (p<0.001). Overall, the study demonstrated that psoriasis is associated with significant biochemical abnormalities involving Vitamin D deficiency, elevated prolactin, increased systemic inflammation, and enhanced T-cell activation.

Among all biomarkers evaluated, CRP emerged as the most reliable indicator of disease activity, suggesting its potential role in objective assessment and monitoring of psoriasis.

Table 3: Summary of Key Findings of the Present Study

Biomarker	Cases Mean ±SD	Controls Mean ±SD	p-value	Direction	PASI score(r)	ANOVA(F)
Vitamin D (ng/mL)	16.66±4.53	29.87±7.82	**<0.001**	↓ Decreased	r=0.0316(NS)	F=0.16(NS)
Prolactin (ng/mL)	13.85±6.21	8.22±2.89	**<0.001**	↑ Increased	r=0.2174(NS)	F=0.83(NS)
CRP (mg/d[)	11.06±5.20	3.29±1.39	**<0.001**	↑ Increased	r=0.6349(HS)	F=14.64(HS)
ADA (U/L)	22.71±5.99	11.50±2.83	**<0.001**	↑ Increased	r=0.1530(NS)	F=1.21(NS)

Discussion

The present hospital-based case-control study was undertaken to investigate the association of serum Vitamin D, prolactin, C-reactive protein (CRP), and adenosine deaminase (ADA) with psoriasis and to evaluate their relationship with disease severity. Psoriasis is now widely regarded as a chronic systemic inflammatory disorder rather than a disease confined to the skin. The persistent activation of immune pathways, particularly the IL-23/Th17 axis, results in excessive keratinocyte proliferation, chronic inflammation, and multiple metabolic and cardiovascular comorbidities. The findings of the present study further support this concept by demonstrating significant alterations in biomarkers representing different biological pathways, including immune regulation, neuroendocrine function, systemic inflammation, and cellular immunity.

The demographic characteristics of the study population showed that psoriasis occurred predominantly in middle-aged adults, with a mean age of 44.87 ± 8.41 years. Age and gender distributions were comparable between cases and controls, thereby reducing the possibility of demographic bias. Plaque psoriasis constituted the majority of cases, accounting for more than four-fifths of the study population, consistent with its known predominance among the various clinical subtypes. Most patients had moderate disease severity based on PASI scoring, reflecting the pattern commonly encountered in tertiary care hospitals, where patients with persistent or symptomatic disease are more likely to seek specialized medical attention.

A major observation of the present study was the marked reduction in serum Vitamin D levels among psoriasis patients compared with healthy individuals. Furthermore, every patient with psoriasis demonstrated either Vitamin D insufficiency or deficiency, with more than half of the patients falling into the deficient category. Vitamin D plays a crucial role in maintaining immune homeostasis by regulating keratinocyte differentiation, suppressing pro-inflammatory cytokine production, and promoting regulatory T-cell activity. Therefore, inadequate Vitamin D levels may contribute to persistent immune activation and maintenance of psoriatic inflammation. Although Vitamin D concentrations were significantly reduced in psoriasis patients, no statistically significant association was observed between Vitamin D levels and PASI score. This finding suggests that Vitamin D deficiency may represent a background metabolic or immunological abnormality associated with psoriasis rather than a direct indicator of disease severity. Uniformly low Vitamin D levels among patients and the relatively limited number of severe cases may also have reduced the ability to detect a significant correlation.

Another important finding was the significant elevation of serum prolactin in psoriasis patients. Traditionally recognized as a pituitary hormone involved in lactation, prolactin is now known to possess cytokine-like properties and to participate in immune regulation. Experimental studies have demonstrated that prolactin promotes lymphocyte proliferation, stimulates inflammatory cytokine release, enhances angiogenesis, and increases keratinocyte proliferation, all of which contribute to the development of psoriatic lesions. In the present study, prolactin levels were significantly higher in cases than in controls, supporting its role in psoriasis pathogenesis. Although prolactin values tended to increase with increasing PASI scores, this trend did not achieve statistical significance. These findings imply that prolactin may participate in disease initiation and persistence but may not accurately reflect changes in clinical severity over time.

Among all biochemical parameters evaluated, CRP emerged as the most clinically relevant biomarker. Serum CRP levels were significantly higher in psoriasis patients than in healthy controls and showed a progressive rise from mild to severe disease. In addition, CRP demonstrated a strong positive correlation with PASI score, indicating that increasing systemic inflammation parallels worsening clinical severity. Since CRP synthesis is stimulated by cytokines such as IL-6, TNF-α, and IL-1β, elevated CRP reflects the inflammatory burden associated with psoriasis rather than cutaneous involvement alone. The strong relationship between CRP and disease severity observed in this study suggests that CRP may serve as a practical and objective biomarker for monitoring disease activity. Because CRP estimation is inexpensive, standardized, and widely available, its routine assessment may also help identify patients with greater systemic inflammation and an increased risk of cardiovascular complications.

Serum ADA activity was also significantly increased among psoriasis patients compared with controls, indicating enhanced cellular immune activation. ADA is an important enzyme in purine metabolism and plays a central role in T-lymphocyte proliferation and function. Increased ADA activity reduces the concentration of extracellular adenosine, an endogenous anti-inflammatory mediator, thereby promoting sustained immune activation. Although ADA values showed an increasing trend with greater disease severity, neither correlation analysis nor comparison across PASI categories reached statistical significance. This observation suggests that elevated ADA reflects generalized activation

of cell-mediated immunity in psoriasis rather than the extent of clinical disease. The relatively small number of patients with severe psoriasis may have limited the statistical power to detect significant differences between severity groups.

The simultaneous evaluation of Vitamin D, prolactin, CRP, and ADA represents an important strength of the present study. Each biomarker reflects a different aspect of psoriasis pathogenesis: Vitamin D indicates immune modulation, prolactin reflects neuroendocrine-immune interactions, CRP measures systemic inflammation, and ADA represents cellular immune activation. Assessing these biomarkers together provides a broader understanding of the biological processes underlying psoriasis than reliance on any single laboratory parameter. Such a multi-biomarker approach may improve objective assessment of disease status and complement clinical indices such as PASI.

Overall, the findings of this study reinforce the concept that psoriasis is a multifactorial systemic inflammatory disease involving complex interactions between immune, endocrine, and inflammatory pathways. Patients with psoriasis demonstrated significantly lower Vitamin D levels together with significantly higher prolactin, CRP, and ADA concentrations compared with healthy controls. Among these biomarkers, CRP showed the strongest association with disease severity, highlighting its potential utility for disease monitoring in routine clinical practice. Although Vitamin D, prolactin, and ADA were significantly altered in psoriasis, their relationship with PASI score was not statistically significant, suggesting that these markers may reflect disease pathophysiology rather than short-term clinical severity. Larger multicentric prospective studies with long-term follow-up are warranted to validate these findings and determine whether a combined biomarker panel can improve diagnosis, prognostication, therapeutic monitoring, and risk stratification in patients with psoriasis.

Conclusion

The present study demonstrated that psoriasis is associated with significant biochemical alterations involving immune, inflammatory, endocrine, and cellular immune pathways. Compared with healthy controls, patients with psoriasis exhibited significantly lower serum Vitamin D levels and significantly higher serum prolactin, C-reactive protein (CRP), and adenosine deaminase (ADA) levels, indicating the multisystem nature of the disease. These findings support the concept that psoriasis is not merely a localized skin disorder but a chronic systemic inflammatory condition with complex underlying pathophysiological mechanisms.

Among the biomarkers evaluated, CRP emerged as the most reliable indicator of disease activity, showing a significant positive association with PASI score and increasing progressively with disease severity. In contrast, although Vitamin D deficiency, elevated prolactin, and increased ADA activity were consistently observed in psoriasis patients, their correlations with disease severity were not statistically significant. This suggests that these biomarkers may be more closely related to disease pathogenesis than to the extent of clinical involvement.

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