Medical Science Journal for Advance Research


Vol. 6, No. 2, June 2025
*e*-ISSN: 2774-4892

# Assessment of Human Beta Defensin-2 (Hbd-2) and Calprotectin, as Potential Biomarkers in Psoriasis

**Samar Hasan Shammar**
*Department of Biochemistry, College of Medicine, University of Babylon, Babylon, Iraq.*
Email: med.samar.hassan@uobabylon.edu.iq

**ABSTRACT**

***Background***: *Human beta defensing 2 and calprotectin are usually not examined in relationship to one's serum and psoriasis severity where as HBD-2 is overexpressed in the epidermis of psoriatic skin. Furthermore, calprotectin helps in sustaining physiological and pathological processes of psoriasis.* ***Objectives***: *The aim of this study was to determine serum levels of Human β-defensin-2 and Calprotectin in psoriasis patients, analyze the relation to disease severity measured by the Rule of Nines, and study correlates of the studied demographic and clinical factors on such biomarkers.* ***Methods***: *This study was conducted on 100 subjects (50 psoriasis patients and 50 healthy controls of matched age and gender). Psoriatic participants were further subdivided into mild, moderate, and severe groups. Serum levels of HBD-2 and Calprotectin were assessed by ELISA. Statistical tests were performed to evaluate differences between groups and levels of the measured biomarkers.* ***Results***: *Markedly higher levels of HBD-2 and calprotectin were observed among the psoriasis patients in comparison to the controls ($p < 0.05$).* ***Conclusion***: *hBD-2 and calprotectin appear to provide complementary information regarding localized skin inflammation and systemic inflammation respectively, while both skin and systemic inflammation was worsened by the condition's activity. hBD-2 and calprotectin psoriasis biomarkers would improve disease management by allowing for the objective assessment of the disease and thus facilitate the tailoring of treatment plans.*

**Keywords: Psoriasis, Human Beta Defensin-2 (Hbd-2), Calprotectin, ELISA**

**Article Information**
Received: April 22, 2025; Revised: May 27, 2025; Online: June, 2025

## INTRODUCTION

Psoriasis is a lifelong illness caused by an exaggerated immune response which accelerates the production of skin cells leading to patches of abnormal skin. These patches appear in red, pink, or purple coloration and are often dry and scaly (1). Psoriasis exhibits a spectrum of severity, from mild confined plaques to severe extensive body surface involvement. Skin trauma or injury to previously affected skin can trigger the development of psoriatic changes. Psoriasis has five main types which include plaque, guttate, inverted, pustular, and erythrodermic. The most common form known as plaque psoriasis, or psoriasis vulgaris, constitutes approximately 90% of the cases. It usually appears as erythematous plaques with overlying scales (2). The most common sites of the body impacted include the posterior forearms, shins, abdominal region, and scalp. Guttate psoriasis features drop-shaped lesions.

Pustular psoriasis is the presence of multiple small sterile pus-filled blisters. Inverse psoriasis displays red lesions in the skin folds (3). Any other form of psoriasis may progress to erythrodermic psoriasis that is Rash has widespread involvement. Most of the people with psoriasis experience some degree of destruction of the nails and toenails. Erosive nail


https://doi.org/10.46966/msjar.v6i2.266

psoriasis might be one manifestation of this. A visual examination of the skin is often sufficient in making a diagnosis of psoriasis. Psoriasis is described as scaly, erythematous plaques, papules or some form of painful skin lesions. Estimates suggest that around 2-4 percent of people living in the Western world are suffering from psoriasis (4). The prevalence of psoriasis varies by age, geography, and ethnicity which is due to a complex mix of genetic and environmental factors. People of European ancestry are approximately five times more likely to develop psoriasis than people of Asian ancestry (5).

A variety of serum inflammatory biomarkers, including erythrocyte sedimentation rate, fibrinogen level, and high-sensitivity C-reactive protein are indicative of psoriasis severity. Overexpression of human beta defensin 2 occurs in psoriasis lesions. Patients suffering from psoriasis show higher levels of serum human beta defensin 2 than the control group. Beta-defensins are low molecular weight peptides, secreted, 3 to 5 kDa in size. These peptides have potent anti-microbial properties against gram positive, gram negative bacteria, fungi and viruses as they are produced by epithelial tissues (6). The possess vehement inflammatory activity with antibacterial action as they serve as chemokines for neutrophils, mast cells, memory T-cells and immature dendritic cells. The lower levels of infections noted in psoriatic cases may explain the significantly higher concentration of an antimicrobial peptide in psoriatic skin (7).

Calprotectin is a calcium-zinc binding protein produced by monocytes and neutrophils that plays a role in many physiological and pathological processes such as immune response regulation, inhibition of cellular division, and prevention of infection by pathogenic microorganisms. There is significant evidence ascertaining the expression of calprotectin correlates with the onset and progression of a number of immunological disorders such as systemic lupus erythematosus (SLE), rheumatoid arthritis (RA), and psoriasis (8).

## MATERIALS AND METHODS

In this case-control research, 100 individuals were included; 50 of them had Psoriasis, while the remaining 50 seemed to be in excellent health. Every sample was collected between June 2024 and March 2025. Samples were obtained from patients who had registered visits to the dermatological clinics at the Hilla General Teaching Hospital and Imam Al-Sadiq Teaching Hospital. A great deal of information was documented, such as the patient's history, sex, age, duration, and severity.

Dermatologist doctors diagnosed patients and classified patient groups, including smokers, those who had received medication within the previous three months, and those with chronic conditions such as diabetes, hypertension, and cancer, based on selection and exclusion criteria.

Psoriasis patients were further classified into three groups: mild, moderate, and severe, based on the Rule of Nine. Serum concentrations of Human Beta Defensin-2 (Hbd-2) and Calprotectin were quantified by Enzyme-Linked Immunosorbent Assay (ELISA). A blood sample was extracted from the vein of each participant. Following the meticulous introduction of blood into a gel tube and allowing it to coagulate for 10 to 15 minutes at ambient temperature, the sample underwent centrifugation for 10 minutes at 3000 x g. The serum is subsequently removed and transferred into an Eppendorf tube.

## STATISTICAL ANALYSIS

The results from the current inquiry, which compares the patient and control groups, were analyzed using the t-test. The findings validated a statistically significant mean

 

difference between the two groups (p-value < 0.05). Determinations of HRD-2 and Calprotectin levels were conducted using data acquired from IBM Statistical for the Social Sciences (SPSS V. 26).

## RESULTS

The study "Assessment of Human Beta Defensin-2 (Hbd-2) and Calprotectin, as Potential Biomarkers in Psoriasis" follows in the footsteps of earlier studies in constructing the results section around biomarker elements relevant to the patients' demographics, as well as the affected individuals compared with controls.

**Demographic and Clinical Characteristics:** (Table 1) offers demographic and clinical details of the study participants. It provides the average value alongside the standard deviation for age and BMI in both the patients and control groups. The table suggests that there was no statistically significant difference in either age or BMI for the two groups. Also included in (Table 1) is the distribution of participants by sex, family history of psoriasis, smoking, and residence (urban/rural) for both groups as frequencies (N) and percentages (%). For the patient group, (Table )1 describes the level of disease severity (mild, moderate, and severe) along with the number and percentage of patients to fit each category.

**Comparison of Hbd-2 Levels:** (Table 2) analyzes the differences in serum Human Beta Defensin-2 (Hbd-2) between participants with Hbd-2 and patients in the control and case groups. It presents the average value and standard deviation of the obtained Hbd-2 results (ng/ml) for each group along with their p value. The data reported in (Table 2) indicate that there is a statistically significant difference in Hbd-2 levels between the two groups, which was higher for psoriasis patients.

**Comparison of Calprotectin Levels:** (Table 3) analyzes the serum level of Calprotectin in both patients and controls, thus creating two larger groups. Following the format of (Table 2), it shows the mean and standard deviation of Calprotectin levels (ng/ml) for each group and the p-value. The data presented in (Table 3) shows a statistically significant difference in Calprotectin levels where psoriasis patients had higher levels. Hbd-2 and calprotectin levels by severity: Table 4 analyzes the Hbd-2 and Calprotectin levels in the subgroups of psoriasis patients (mild, moderate, and severe) for comparatives. It displays the mean and standard deviation of Hbd-2 and Calprotectin levels for each severity group along with the relevant p-value. The data shown in (Table 4) demonstrates that there is a statistically significant increase in Hbd-2 and Calprotectin levels with disease severity. The tables together offer a coherent narrative about the data, enabling easy inter-group comparison, while also highlighting the interdependence of the biomarker and the parameters of the disease.

**Table (1):** Demographic and Clinical Characteristics of Psoriasis Patients: A Comparative Study with Healthy Controls.

| | | Mean (n=50) | SD (n=50) | P value |
|---|---|---|---|---|
| Age | Patient | 33.7 | 13.2 | >0.05 |
| | Control | 31.9 | 8.5 | |
| BMI | Patient | 25.35 | 6.47 | >0.05 |
| | Control | 24.46 | 4.18 | |

| | | | N | Percent % | |
|---|---|---|---|---|---|
| Sex | Patient | Male | 22 | 46.7 | |
| | | Female | 28 | 53.3 | |
| | Control | Male | 30 | 53.3 | |
| | | Female | 20 | 46.7 | |
| Family History | Patient | Positive | 21 | 36.7 | |
| | | Negative | 39 | 63.3 | |
| Smoking | Control | Yes | 23 | 33.3 | |
| | | No | 27 | 66.7 | |
| | Patient | Yes | 22 | 20.0 | |
| | | No | 28 | 80.0 | |
| Residence | Control | Urban | 24 | 56.7 | |
| | | Rural | 26 | 43.3 | |
| | Patient | Urban | 40 | 75.0 | |
| | | Rural | 10 | 25.0 | |
| Degree of Severity of Disease | | Mild | 21 | 17.5 | |
| | | Moderate | 19 | 15.8 | |
| | | Sever | 20 | 16.7 | |

**Table (2):** Comparison of Human Beta Defensin-2 (Hbd-2) levels between the study groups.

| | | Control N=50 | | Patients N=50 | | P. Value |
|---|---|---|---|---|---|---|
| Serum Hbd-2 ng/ml | Mean±SD | 34.6 | 6.65 | 80.9 | 8.9 | **< 0.05** |

SD: standard deviation, Human Beta Defensin-2 (Hbd-2)

**Table (3):** Comparison of Calprotectin levels between the study groups.

| | | Control N=50 | | Patients N=50 | | P. Value |
|---|---|---|---|---|---|---|
| Serum Calprotectin (ng/ml) | Mean±SD | 295.6 | 20.03 | 402.9 | 14.9 | < 0.05 |

SD: standard deviation

**Table (4):** Comparison of Hbd-2 and Calprotectin levels between the study groups according to severity.

| | | Hbd-2 | | | P. Value |
|---|---|---|---|---|---|
| Degree of severity | Mild | 74.3 | ± | 3.5 | 0.05 |
| | Moderate | 79.1 | ± | 5.1 | |
| | Sever | 85.1 | ± | 2.8 | |

| | | Calprotectin | | | P. Value |
|---|---|---|---|---|---|
| | Mild | 387.1 | ± | 6.2 | 0.05 |
| | Moderate | 402.09 | ± | 8.2 | |
| | Sever | 410.3 | ± | 9.8 | |

## DISCUSSION

Psoriasis is an immune-mediated chronic inflammatory skin disease that manifests through the aberrant expansion of keratinocytes and immune cell attack. There is still no single best method of reliably distinguishing different forms of psoriasis, monitoring the disease inactivity duration, or measuring treatment effectiveness at different stages within the complex pathogenesis framework of psoriasis. Within this regard, Human Beta Defensins 2 (HBD-2) and Calprotectin (S106A8/A9) have stood out as potential biomarker candidates (citation). Moreover, the lack of HBD-2 detection in blood or skin biopsies, its response to anti-TNF and biological treatments, as per Jin et al (10), underscores its value in progress of the treatment monitoring. Such HO-lytic HBD-2s were proposed to be produced by keratinocytes mainly in response to microbial agents or pro-inflammatory cytokines (for instance IL-1b and TNF-alpha), tend to fall under the classification of priors which in perpetuity lead to the eruption of chronic inflammation and skin barrier disruption in psoriasis.

Consistent with other studies, in our study psoriasis patients exhibited an unusually heightened degree of HBD-2 in comparison to the control group. These results are consistent with Stephen Chu-Sung Hu et al. who reported that the level of HBD-2 produced by keratinocytes in the epidermis is higher than expected in patients with psoriasis (11). Calprotectin, a calcium-binding protein released primarily from neutrophils and monocytes, is a potent mediator in innate immunity because it regulates the movement of leukocytes, secretion of cytokines, and amplification of inflammation (12). Our findings showed that Calprotectin levels in psoriasis patients were markedly elevated, which corroborates prior findings of heightened Calprotectin levels in psoriasis lesions and in serum (13). This increase might suggest the presence of underlying inflammation and its likely relationship with psoriatic arthritis (PsA). M. Qian and N.-J. Song (14) found that serum calprotectin concentration correlates with the risk and severity of psoriasis and that reduction of calprotectin is a sign of better response with tumor necrosis factor inhibitors. These findings parallel ours, further reinforcing Calprotectin's utility as a biomarker for disease severity and treatment responsiveness. Additionally, as pointed out by Criselda Jean G. Cruz and Chao-Chun Yang (12), Calprotectin's functional accessibility in various biosamples underscores its usefulness as an early marker for joint involvement in psoriasis and for assessing the therapeutic response. Our study's novel finding is the marked increase in both HBD-2 and Calprotectin levels with disease severity, which is shown in Table 4. Other studies have documented the elevation of these biomarkers in psoriasis, but our findings add further support to their potential for differentiation among mild, moderate, and severe cases.

## CONCLUSION

our findings, in conjunction with existing literature, support the promise of HBD-2 and Calprotectin as non-invasive biomarkers for psoriasis. While both biomarkers correlate with disease severity and may aid in monitoring therapeutic responses, it is crucial to acknowledge their presence in other

inflammatory conditions. Therefore, they are likely to be most effective when used as part of a biomarker panel. To validate their specificity and predictive value in clinical practice, further longitudinal and multicenter studies are warranted.

## CLINICAL SIGNIFICANCE

The increased levels of HBD-2 and Calprotectin in relations to the severity of psoriasis seems to indicate that those biomarkers can be utilized to track the activity of the disease and its progression within a clinical framework. This may be beneficial for the clinicians as it will enable them to more accurately formulate treatment plans and possibly customize treatment regimens depending on the levels of the biomarkers. In addition, changing levels of HBD-2 and Calprotectin during the course of the treatment could enable the tracking of the treatment response which with the proper planning could make the management of the patients more effective from the outset. The finding of such accurate biomarkers as HBD-2 and Calprotectin, while perhaps enhancing the prospect of objective clinical evaluation, would enhance the prospects of an objective and quantifiable approach to the management of psoriasis.

## ACKNOWLEDGEMENTS

All patients who participated in this study are deeply appreciated. We would also like to thank the technical staff of the Biochemistry department of University of Babylon.

## FINANCIAL SUPPORT

Funds Received from Personally Funded Parties

## ETHICS APPROVAL

Every participant in the study was informed and had a chance for verbal consent before sample collection took place. The ethics committee at one of the local colleges and hospitals reviewed and gave approval for the study protocol.

## CONFLICTS OF INTEREST

No competing interests have been declared by the authors for this manuscript from other sources, financial or otherwise.

# REFERENCES

1. Coates LC, Soriano ER, Corp N, et al. Group for Research and Assessment of Psoriasis and Psoriatic Arthritis (GRAPPA): updated treatment recommendations for psoriatic arthritis 2021. Nat Rev Rheumatol 2022;18:465-79.

2. Wang X, Zhang M, Chen Y, et al. Risk for Hepatitis B Virus Reactivat- ion in Patients with Psoriasis Treated with Biological Agents: A Systematic Review and Meta-Analysis. Dermatol Ther (Heidelb) 2022;12:655-70.

3. Chiu H-Y, Chiu Y-M, Chang Liao N-F, et al. Predictors of hepatitis B and C virus reactivation in patients with psoriasis treated with biologic agents: a 9-year multicenter cohort study. J Am Acad Dermatol 2021;85:337-44

4. Lambert JLW, Segaert S, Ghislain PD, et al. Practical recommend -dations for systemic treatment in psoriasis in case of coexisting inflammatory, neurologic, infectious or malignant disorders (BETA-PSO: Belgian Evidence-based Treatment Advice in Psoriasis; part 2). J Eur Acad Dermatol Venereol 2020;34:1914-23.

5. Gottlieb AB, Ryan C, Murase JE. Clinical considerations for the management of psoriasis in women. Int J Womens Dermatol 2019;5:141-50.

6. Bikash R. Kar, Dharshini Sathishkumar1, Sushil Tahiliani2, Anchala Parthasarathi3 ,,Biomarkers in Psoriasis: The Future of Personalised Treatment, Indian Journal of Dermatology |Volume 69 | Issue 3 | May-June 2024

7. Morita, A., Tani, Y., Matsumoto, K., Yamaguchi, M., Teshima, R., and Ohtsuki, M. (2020). Assessment of serum biomarkers

 

in patients with plaque psoriasis on secukinumab. J. Dermatol 47 (5), 452–457.

8. Hagg D, Sundstrom A, Eriksson M, Schmitt –Egenolf M. Severity of psoriasis differs between men and women: a study of the clinical outcome measure Psoriasis Area and Severity Index (PASI) in 5438 Swedish register patients. Am J Clin Dermatol 2017; 18: 583-590.

9. Conrad, C., and Gilliet, M. (2018). Psoriasis: From pathogenesis to targeted therapies. Clin. Rev. Allergy & Immunol. 54 (1), 102–113.

10. Jin, T., Sun, Z., Chen, X., Wang, Y., Li, R., Ji, S., et al. (2017). Serum human betadefensin- 2 is a possible biomarker for monitoring response to JAK inhibitor in psoriasis patients. Dermatology 233 (2-3), 164–169.

11. Stephen Chu-Sung Hu1,2, Hsin-Su Yu1,2,3, Feng-Lin Yen4, Chi-Ling Lin2,5, Gwo-Shing Chen1,2 & Cheng-Che E. Lan1,, Neutrophil extracellular trap formation is increased in psoriasis and induces human β-defensin-2 production in epidermal keratinocytes, Scientific Reports | 6:31119 |

12. Criselda Jean G. Cruz1,2 and Chao-Chun Yang1, Clinical application of serum biomarkers for detecting and monitoring of chronic plaque Psoriasis, Frontiers in Molecular Biosciences, 10.3389/fmolb.2023. 1196323

13. Hamza, A., Hassan, E., Donia, H., and Maamon, Y. (2019). Serum calprotectin as a predictive biomarker in the treatment of psoriasis vulgaris with methotrexate. J. Egypt. Womenís Dermatologic Soc. 16 (2), 112–118.

14. M. QIAN, N.-J. SONG, Serum calprotectin correlates with risk and disease severity in psoriasis patients and the decrease of calprotectin predicts better response to tumor necrosis factor inhibitors, European Review for Medical and Pharmacological Sciences, 2018; 22: 4299-4309

 