

C-reactive protein to albumin ratio: An independent prognostic marker to assess the severity of disease in patients with psoriasis vulgaris

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ABSTRACT

Objective: To determine the relationship between the C-reactive protein to albumin ratio (CAR) and disease severity in patients with psoriasis vulgaris using the Psoriasis Area and Severity Index (PASI).

Material and Methods: This cross-sectional study was conducted in the Department of Dermatology, Combined Military Hospital Malir Cantt, Karachi. A total of 94 adults with clinically and histopathologically confirmed psoriasis vulgaris were enrolled. Disease severity was assessed using PASI. Venous blood samples were collected to measure serum CRP and albumin levels, and CAR was calculated. Pearson correlation was used to evaluate the association between CAR and PASI.

Results: Among 94 patients, the mean age was 52.2 ± 18.09 years, and 57.4% were male. The mean PASI score was 10.66 ± 6.06 , while the mean CAR was 2.71 ± 1.91 . CAR showed a strong positive correlation with PASI in the overall sample ($r = 0.808$, $p < 0.001$). This association remained significant across subgroups based on gender, age, and disease duration, with the strongest correlations in patients with disease duration ≤ 24 months ($r = 0.862$, $p < 0.001$) and age > 60 years ($r = 0.849$, $p < 0.001$).

Conclusion: CAR is strongly associated with psoriasis severity and may serve as a simple, inexpensive, and objective biomarker in clinical assessment.

Keywords: Albumin, Biomarkers, C-reactive protein, CRP/ Albumin ratio, PASI score, Psoriasis vulgaris

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INTRODUCTION

Psoriasis is a persistent, autoimmune, inflammatory dermatosis marked by the excessive proliferation of keratinocytes and the impairment of immunological regulation [1,2]. It manifests in diverse clinical phenotypes, including plaque, guttate, erythrodermic, pustular, palmoplantar, and inverse forms³. Plaque psoriasis, also known as psoriasis vulgaris, is the most common and easiest to see kind. It is usually characterized by strongly defined, red, itchy, scaly plaques that can be small or large and vary in severity [4,5]. The global prevalence of psoriasis ranges from approximately 1–8%, varying by geographic region. In East Asia, prevalence is reported as low as 0.17%, whereas in Western Europe it reaches up to 2.5%. In Pakistan, psoriasis affects an estimated 2–4% of the population [6]. The disorder often begins in childhood and has a significant effect on quality of life [7].

The pathophysiology of psoriasis is complex, encompassing keratinocyte hyperproliferation, aberrant differentiation, and the invasion of inflammatory immune cells. Due to its inflammatory characteristics, dependable biomarkers are crucial for evaluating disease activity, informing therapy choices, and tracking treatment efficacy [8,9]. Hematological and biochemical indicators, including serum albumin, C-reactive protein (CRP), mean platelet volume (MPV), neutrophil to lymphocyte ratio (NLR), platelet to lymphocyte ratio (PLR), and others, have been linked in previous research to the severity of psoriasis [10–12]. Nevertheless, the predictive significance of the C-reactive protein/albumin ratio (CAR), a novel composite index that integrates both inflammatory and nutritional states, has not been investigated within the Pakistani community.

CAR has already been proposed as a prognostic biomarker in several inflammatory conditions, including ischemic stroke and cardiovascular diseases, and may serve as a sensitive indicator of systemic inflammation in psoriasis patients receiving biologic therapy [13,14]. Supporting this, Kemeriz *et al.* demonstrated that CAR significantly correlated with psoriasis severity, reporting median values of 0.17, 1.12, and 2.6 in mild, moderate, and severe psoriasis, respectively [14]. Based on this finding, the objective of our study is to examine the correlation

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between CAR and disease severity in psoriasis vulgaris within our local environment. Establishing such a correlation could justify incorporating CAR into routine screening, where elevated values may identify patients with poorer prognosis who require closer monitoring and timely initiation of systemic disease-modifying therapies.

MATERIAL AND METHODS

This cross-sectional research was conducted at the Department of Dermatology, Combined Military Hospital Malir Cantt, Karachi, from 01 March 2025 to 30 September 2025, after approval from the Institutional Review Board/Ethical Review Committee of Combined Military Hospital Malir Cantt, Karachi (ERC No. CMH-MC/ERC/2025/017, dated 25 February 2025). The sample size of 94 participants was calculated using OpenEPI software based on the known proportion of mild cases of psoriasis, with a 95% confidence interval and 9% margin of error, taking reference from Kemeriz *et al.* [16]. Participants were recruited using a non-probability consecutive sampling technique. The study included adults aged 18 to 80 years of either gender, with a confirmed clinical and histopathological diagnosis of psoriasis vulgaris. Individuals with other psoriasis subtypes (such as psoriatic arthritis or pustular psoriasis), those with conditions that could confound inflammatory markers (including active infections, malignancies, metabolic syndrome, or other systemic inflammatory diseases), patients who had received topical or systemic corticosteroids, immunosuppressants, or biologic therapy within the preceding four weeks were excluded from this study. The lead investigator thoroughly assessed each subject and documented their clinical history and demographics. The severity of psoriasis was objectively assessed using the PASI scoring, with scores classified as mild (<7), moderate (7-12), or severe (>12). Venous blood was collected for laboratory analysis under aseptic circumstances. Serum C-reactive protein (CRP) and albumin levels were measured using automated chemistry analyzers following standard laboratory protocols ranges of 3.5–5.2 g/L and 0–5 mg/L, respectively. The CAR is a dimensionless ratio calculated by dividing serum CRP (mg/L) by serum albumin (g/L) was thereafter computed for each participant as the straightforward ratio of these two values.

SPSS version 25 was used to conduct the statistical analysis. The descriptive data were presented as mean $\pm$ standard deviation for the quantitative

variables, including age, disease duration, PASI, CRP, albumin, and CAR. Gender, residence, and severity categories were represented by frequencies and percentages. The Pearson correlation test was employed to assess the relationship between CAR and PASI score. To guarantee the integrity of the findings, the possible impact of effect modifiers such as gender, age categories and disease duration was managed via post-stratification analysis, with a p -value ≤ 0.05 considered statistically significant computed for each participant as the ratio.

RESULTS

The research encompassed 94 individuals diagnosed with psoriasis vulgaris. The patient population was primarily male (57.4%) with a mean age of 52.2 ± 18.09 years, displaying a broad spectrum of PASI scores ranging from 2 to 25. A calculated CAR demonstrated significant variation, ranging from 0.49 to 7.99. Mean CRP and albumin levels were 11.4 ± 7.8 mg/L and 4.28 ± 0.33 g/L, the distribution of CAR values corresponded closely with PASI-based disease severity categories, as detailed in Tables-I and 2, resulting in a mean CAR of 2.71 ± 1.91 . This quantitative range of CAR aligns meaningfully with the qualitative distribution of patients across mild (31.9%), moderate (39.4%), and severe (28.7%) clinical severity groups, suggesting a potent correlation between this novel inflammatory biomarker and the clinical burden of psoriasis (Table-I), (Table-II).

The results of the correlation study showed that the PASI scores and the CAR were positively correlated. The Pearson correlation coefficient was $r = 0.808$ ($p < 0.001$), signifying a robust association between elevated CAR values and increased disease severity in individuals with psoriasis vulgaris. The relationship between CAR and psoriasis severity remained consistently significant across all subgroups. Correlations were strong in both males ($r = 0.803$) and females ($r = 0.817$), across age groups with the highest in patients >60 years ($r = 0.849$), and by disease duration, being strongest in those ≤ 24 months ($r = 0.862$). Correlation analysis is illustrated in Table-III.

Table-I: Demographic profile of the study population (quantitative variables) n=94

Variable	Minimum	Maximum	Mean	Std. Deviation
Age (years)	18.0	79.0	52.23	18.09
Duration (months)	9.0	239.0	122.34	69.77
PASI Score	2	25	10.77	6.08
CRP (mg/L)	2.1	33.8	11.35	7.77
Albumin (g/L)	3.51	4.99	4.28	0.33
CAR	0.49	7.99	2.71	1.91

Table-II: Demographic profile of the study population (qualitative variables) n=94

Variable	Frequency	Percentage (%)
Gender		
Male	54	57.4
Female	40	42.6
Age Group		
≤ 40 years	24	25.5
41–60 years	36	38.3
> 60 years	34	36.2
Residence		
Urban	56	59.6
Rural	38	40.4
Duration of Disease		
Upto 24 months	19	20.2
>24 months	75	79.8

Table-III: Correlation analysis among C-reactive protein to albumin ratio (CAR) and Psoriasis Area and Severity Index (PASI) score

Subgroup	N	Pearson Correlation (r)	p-value
Overall Study Population	94	0.808	<0.001
Gender			
Male	54	0.803	<0.001
Female	40	0.817	<0.001
Age Groups			
≤ 40 years	24	0.796	<0.001
41–60 years	36	0.752	<0.001
> 60 years	34	0.849	<0.001
Duration of Disease			
≤ 24 months	19	0.862	<0.001
> 24 months	75	0.801	<0.001

DISCUSSION

This study reveals a strong and statistically significant positive correlation between the CAR and disease severity in individuals with psoriasis vulgaris, establishing CAR as an effective biomarker that reflects the complex inflammatory load of this systemic disorder. Our principal discovery demonstrates a robust, positive connection between CAR and PASI scores ($r = 0.808$, $p < 0.001$), validating our primary hypothesis and highlighting the significant interaction between systemic inflammation and the appearance of cutaneous illness.

The robustness of this link is not only a statistical finding but also an indication of the distinct biological explanation of CAR. CRP is a recognized acute-phase reactant that increases due to interleukin-6 mediated inflammation, whereas albumin is a negative acute-phase protein that diminishes under similar inflammatory conditions. Psoriasis, a systemic inflammatory condition [15,16], disrupts both parameters together. Consequently, CAR functions as a dynamic enhancer of this inflammatory signal, synthesizing the increase of a pro-inflammatory

marker and the decrease of an anti-inflammatory one into a singular, sensitive metric [19,20]. This is powerfully justified by our data, which shows a wide range of CAR values (0.49 to 7.99) that closely mirror the spectrum of clinical severity, from mild to severe PASI scores. The remarkable consistency of this correlation across all subgroups including gender, age, and disease duration, further validates its robustness. Particularly noteworthy is the strongest correlation observed in patients across various subgroups, suggesting CAR may be especially pivotal in identifying aggressive, early-stage disease or in assessing the heightened inflammatory risk profile in older populations.

Our results largely match with those of Kemeriz *et al.*, who documented median CAR values of 0.17, 1.12, and 2.6 for mild, moderate, and severe psoriasis, respectively, in a Turkish cohort, demonstrating a significant incremental increase in CAR associated with PASI severity classifications [16]. Similarly, previous studies have demonstrated the utility of CAR as an inflammatory biomarker in psoriasis and related systemic inflammatory disorders. Balta *et al.*

also observed that CAR was markedly elevated in psoriasis patients relative to healthy controls (0.93 vs. 0.51, $p < 0.001$), and identified a positive association between PASI scores and CAR levels ($r = 0.532$, $p < 0.001$) [21].

The dynamic nature of CAR as an inflammatory marker has also been demonstrated in treatment-response studies. Tamer and Avci evaluated CAR in patients with psoriasis vulgaris undergoing biologic therapy and found that CAR significantly declined following three months of treatment, with the most pronounced reduction observed in the secukinumab group [15]. Their findings highlight CAR as a responsive biomarker capable of monitoring therapeutic outcomes in real time. Taken together with our results, these studies collectively emphasize the utility of CAR not only in grading disease severity but also in longitudinal monitoring of treatment efficacy and systemic inflammation.

The strong correlations in our stratified analyses further strengthen the evidence base. The association between CAR and PASI remained significant across all demographic and clinical subgroups, with slightly higher correlation coefficients observed in females ($r = 0.817$) and in elderly patients (>60 years, $r = 0.849$). Interestingly, the strongest correlation was observed in patients with shorter disease duration (≤ 24 months, $r = 0.862$), suggesting that CAR may be particularly sensitive in capturing early inflammatory activity in newly diagnosed or rapidly progressive cases. These findings are biologically plausible, as early active disease is often characterized by heightened systemic immune activation, reflected in elevated CRP levels and reduced serum albumin due to chronic inflammation [8]. Gul *et al.* similarly described plateletcrit as a marker of disease activity [14]. While these markers such as plateletcrit provide valuable insights, CAR offers distinct advantages by combining two widely available laboratory measures that reflect both acute phase response (CRP) and nutritional/inflammatory status (albumin), thereby integrating systemic inflammatory burden into a single composite index. The persistence of a strong CAR–PASI correlation across gender, age groups, disease duration, and residential status underscores the stability of this biomarker across demographic and clinical strata. Slightly higher correlations observed in females and elderly patients may reflect heightened systemic inflammatory responses in these subgroups, a finding consistent with previous inflammatory disease literature.

CAR, derived from inexpensive and routinely available blood tests (CRP and albumin), offers a readily accessible, quantitative, and objective tool to complement the subjective nature of the PASI score. It can serve as a valuable adjunct for identifying patients with high subclinical inflammation who may be at greater risk for psoriatic comorbidities, such as cardiovascular disease and metabolic syndrome. It also provides an objective measure to track response to systemic therapies beyond skin clearance, potentially predicting long-term efficacy and guiding treatment decisions. It offers a reliable biomarker for cases where PASI assessment might be challenging, providing a holistic view of the patient's inflammatory status. Although most available studies support a positive association between CAR and psoriasis severity, limited data exist exploring contradictory findings. Variability in study populations, exclusion criteria, disease phenotypes, and laboratory thresholds may account for discrepancies. Further multicenter prospective studies are warranted to standardize CAR cut-off values and validate its universal applicability.

LIMITATIONS

Despite these promising findings, certain limitations warrant consideration. Our cross-sectional design precludes causal inference and does not allow assessment of CAR dynamics over time or in response to therapy. Furthermore, exclusion of patients with comorbidities such as psoriatic arthritis, infections, or metabolic syndrome, while methodologically necessary, limits generalizability to the broader psoriasis population. The cross-sectional design allows for the establishment of correlation but not causation. A larger, multi-center prospective cohort study would strengthen these findings and allow for the establishment of definitive CAR cut-off values for different severity grades.

CONCLUSION

The results of our research prove that the CAR is positively and significantly associated with the objectively measured severity of psoriasis vulgaris by the use of the PASI score. This consistent and strong correlation that was stable throughout all the demographic and clinical subgroups highlights the reliability of CAR as a reflective measure of the underlying systemic inflammatory status in psoriasis. The conclusions support the use of this low-cost, easily measurable and regularly present biomarker in the routine clinical evaluation of psoriasis patients.

CAR has a great potential as an important objective measure to supplement clinical assessment, risk stratification of related comorbidities, systemic therapy response, and identifying patients with a high inflammatory burden that may respond to more vigorous treatment measures.

CONFLICT OF INTEREST

None

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Declared none

AUTHORS CONTRIBUTION

Tooba Hadia: Substantial contributions to study design, acquisition of data, manuscript drafting or reviewing it critical for important intellectual content, has given final approval of the version to be published

Sameena Kausar: Substantial contributions to acquisition of data, manuscript drafting or reviewing it critical for important intellectual Content, has given final approval of the version to be published

Ghazala Yasmeen: Substantial contributions to analysis and interpretation of data, critical review, has given final approval of the version to be published

Noor Ul Huda: Substantial contributions to concept, study design, critical review, has given final approval of the version to be published

Rabia Hamid: Substantial contributions to acquisition of data, manuscript drafting or reviewing it critical for important intellectual content: critical review

Nida Khalid: Manuscript drafting or reviewing it critical for important intellectual content, substantial contributions to acquisition of data

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