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Association between MPVLR and Psoriasis: The NHANES 2009-2014

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Abstract

Background and Aim: The mean platelet volume to lymphocyte ratio (MPVLR) has been proposed as a novel clinical marker that appears to offer enhanced utility in comparison to conventional single blood cell markers in the assessment of disease. This study aims to investigate the relationship between MPVLR and Psoriasis (PsO). **Methods:** A cross-sectional study was conducted using data from 14,390 participants in the National Health and Nutrition Examination Survey (NHANES) from 2009 to 2014. Utilising the mean platelet volume to lymphocyte ratio (MPVLR) as the primary exposure, we employed multivariate regression models to assess the association between MPVLR and the risk of psoriasis, and performed subgroup analyses across different age groups. We further employed interaction tests to assess the moderating effect of age on the MPVLR-PsO association. In order to explore potential nonlinear relationships and threshold effects, the present study combined curve fitting with threshold (inflection point K) analysis and evaluated the goodness of fit of the segmented models using model comparison (log-likelihood ratio tests). **Results:** MPVLR was positively associated with the odds of psoriasis. This association showed a consistent direction across age strata, with no significant age-modifying effect in interaction tests. In the 40 - 59 age group, below the threshold of 3.25, each one-unit increase in MPVLR was associated with a 133% increase in the risk of psoriasis; in the ≥60 years group, below the threshold of 8.46, each one-unit increase in MPVLR was associated with a 21% increase in the risk of psoriasis. **Conclusions:** In summary, an elevated MPVLR has been demonstrated to be associated with increased odds of psoriasis, and this relationship exhibits certain age-related nonlinear threshold characteristics. This may provide clinicians with supplementary data to aid in the early diagnosis of psoriasis.

Keywords

Mean Platelet Volume-to-Lymphocyte Ratio (MPVLR), Psoriasis, NHANES, Age-Related, Cross-Sectional Study

1. Introduction

Psoriasis (PsO) is a multifactorial disorder characterised by its systemic, chronic, and recurrent nature and driven by immunological, genetic, and environmental factors. It manifests as patchy or extensive red plaques [1]. The condition is associated with a range of systemic diseases, including, but not limited to, cardiovascular disease [2], diabetes [3], and metabolic syndrome [4]. In the United States, psoriasis affects approximately 7.5 million adults [5]. While pharmacological and physical interventions can alleviate symptoms, the condition remains incurable and significantly impacts patients' lives [6]. Early diagnosis and timely intervention are crucial for preventing health complications. Research is underway to identify effective biological markers for psoriasis, though no simple clinical indicators have yet been identified. The mean platelet volume-to-lymphocyte ratio (MPVLR) is a key prognostic indicator for cardiovascular diseases and tumours. It is a frequently used measure of the body's inflammatory response; however, research on changes in this marker among patients with psoriasis and its association with the disease remains limited. The objective of this study is to examine the association between MPVLR and psoriasis by utilising data from the NHANES database spanning the period from 2009 to 2014.

2. Methods

2.1. Study Population

The NHANES database is a continuous national survey that collects information on the health status and health-related behaviors of people living in the United States. These data are freely accessible via the website: https://www.cdc.gov/nchs/nhanes/. Statistical analyses were conducted in accordance with the CDC guidelines, incorporating the NHANES sample weights, stratification variables, and primary sampling units (PSUs) to account for the complex multistage probability sampling design. In order to combine the three 2-year survey cycles (2009-2010, 2011-2012, and 2013-2014) into a single analytic sample, 6-year examination weights were constructed by dividing the 2-year MEC weights (WTMEC2YR) for each cycle by 3, the number of combined cycles. For our analysis, we used data spanning three 2-year survey cycles from 2009 to 2014. A total of 30,434 individuals aged over 20 years were initially included. After removing 10,923 participants with missing psoriasis data, we then excluded those lacking information on the mean platelet volume to lymphocyte ratio (MPVLR, n = 1598) or other covariates (n = 3524). The final analytical sample thus consisted of 14,390 participants (**Figure 1**).

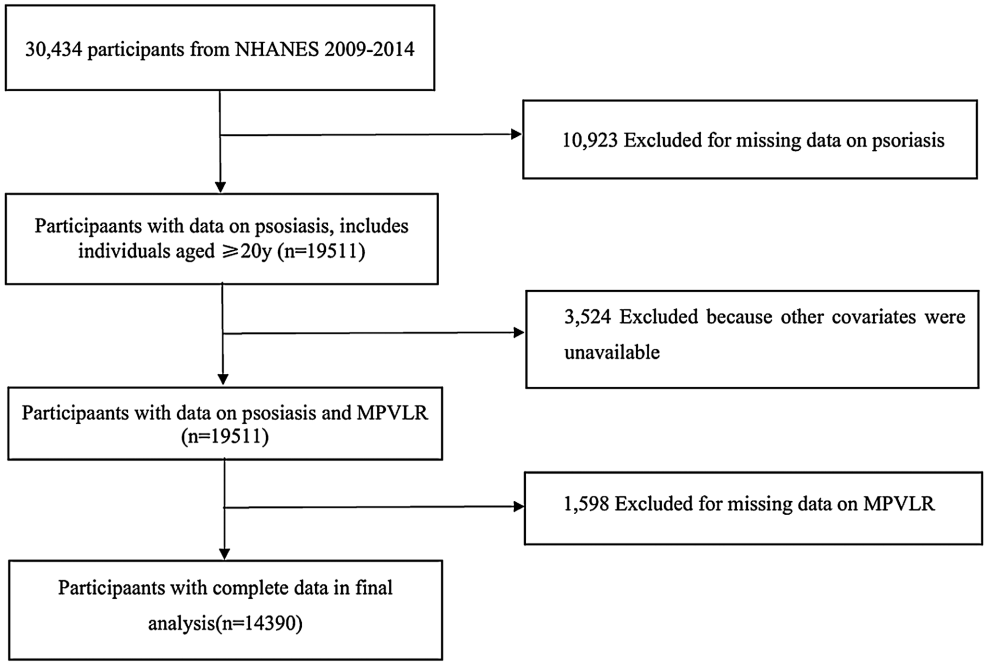

Figure 1. Flow chart of participant selection (NHANES: National Health and Nutrition Examination Survey).

2.2. Assessment of Psoriasis and MPVLR

Psoriasis was defined as an affirmative response to the question, "Have you ever been told by a health care provider that you had psoriasis?"

The MPVLR was calculated using the following formula: MPVLR = MPV/LYM, where MPV is the mean platelet volume, and LYM is the lymphocyte count. Both parameters were derived from the complete blood count (CBC) with 5-part differential, performed on participants aged 1 year and older in the Mobile Examination Centers (MECs). Blood specimens were analyzed using the Beckman Coulter automated hematology analyzer. Mean platelet volume (variable: LBXMPV) was measured in femtoliters (fL), and lymphocyte count (variable: LBDLYMNO) was measured in 1000 cells/μL. The MPV and lymphocyte data were obtained from the NHANES laboratory files for each cycle (2009-2010, 2011-2012, and 2013-2014), with consistent laboratory methodologies applied across all cycles. In the context of multivariable regression analyses, the categorisation of covariates was undertaken with the following reference categories: sex (reference: female), race/ethnicity (reference: Non-Hispanic White), educational level (reference: College Graduate or above), marital status (reference: Married), smoking history (reference: no, never smoked ≥ 100 cigarettes), alcohol consumption (reference: no, <12 drinks per year), hypertension (reference: no), diabetes (reference: no), and hypercholesterolemia (reference: no). Continuous covariates, including age, BMI, MPVLR, fasting blood glucose, OGTT 2-hour glucose, glycated haemoglobin, and total cholesterol, were entered into the regression models as continuous linear variables, unless otherwise specified. All covariates were assessed at their baseline values.

2.3. Assessment of Covariates

All the data analysed in this study was obtained directly from the NHANES database, including age, gender, ethnicity, educational attainment, marital status, income, height, weight, BMI, smoking history, alcohol consumption history, history of hypertension, diabetes and abnormal cholesterol levels, complete blood count, fasting blood glucose, oral glucose tolerance test (OGTT), glycated haemoglobin, and total cholesterol. Participants were classified as having a smoking history if they responded "yes" to ever smoking at least 100 cigarettes. In the case of the question "In any 1 year, have you had at least 12 drinks of any type of alcoholic beverage?", respondents who answered "yes" were classified as individuals who consume alcohol. The data on the history of illness (e.g., diabetes, hypertension, and hypercholesterolemia) were collected through the administration of specific questions to the participants. These questions inquired whether the participants had been informed by a physician of a history of illness or medication for a related condition. The diagnosis of hypertension was determined using the following criteria: systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg [7]. The diagnosis of diabetes was determined using the following criteria: a fasting blood glucose level ≥ 7.0 mmol/L; an OGTT 2-hour blood glucose level ≥ 11.1 mmol/L; and a glycated hemoglobin level ≥ 6.5% [8] [9]. A serum cholesterol level that exceeds 5.2 mmol/L is classified as elevated [10]. Information on the variables and the data collection process is available for consultation at the following URL: https://www.cdc.gov/nchs/nhanes/.

2.4. Statistical Analysis

The statistical analyses were conducted in accordance with the CDC guidelines, incorporating the NHANES sample weights. All regression models were weighted using the constructed 6-year examination weights (WTMEC2YR/3), and the analysis accounted for the complex survey design by incorporating strata and PSUs. Data were presented as mean ± standard deviation for continuous variables and as percentages for categorical variables. A univariate analysis was conducted to examine the relationship between MPVLR and psoriasis, and interaction tests were used to assess whether the association between MPVLR and psoriasis was consistent across age groups. Smooth curve fitting was employed to explore the linear relationship between MPVLR and psoriasis in age subgroups. A regression analysis was subsequently employed to ascertain the point at which the relationship between MPVLR and psoriasis underwent a "qualitative change" across different age subgroups. Statistical analyses were conducted using the Empower Stats (http://www.empowerstats.com, X&Y Solutions, Inc., Boston, MA) and statistical software packages R (http://www.R-project.org, The R Foundation). The statistical significance of a result is defined as two-sided $P < 0.05$. Due to the cross-sectional nature of this study, all odds ratios (ORs) derived from logistic regression models represent associations with psoriasis prevalence odds. The term "risk" used in the following sections, unless otherwise specified, is in-

terpreted within this cross-sectional context and does not imply a temporal causal risk.

3. Results

3.1. Baseline Characteristics

In this cross-sectional study, 14,390 U.S. adults were included, of whom 414 had psoriasis, and 13,976 did not. Compared with the non-psoriasis group, individuals with psoriasis were older and had a higher proportion of non-Hispanic Whites. Regarding health-related status, the psoriasis group showed a greater burden of cardiometabolic comorbidities, including hypertension, diabetes, and abnormal cholesterolemia. In addition, smoking prevalence was higher in the psoriasis group. The mean BMI was also higher among participants with psoriasis. In contrast, educational level and marital status did not differ significantly between groups (Table 1).

Table 1. Basic characteristics of U.S. adult participants categorized by the presence or absence of psoriasis.

Characteristics	No Psoriasis (n = 13,976)	Psoriasis (n = 414)	P Value
Gender (%)			0.7477
Female	50.99	51.77	
Male	49.01	48.23	
Age	47.40 ± 16.94	50.84 ± 15.96	<0.0001
Race (%)			<0.0001
Mexican American	8.39	4.39	
Other Hispanic	5.63	4.73	
Non-Hispanic White	68.14	80.20	
Non-Hispanic Black	10.82	5.12	
Other Race	7.02	5.55	
Education Level (%)			0.5129
Less than 9th Grade	5.07	3.26	
9 - 11th Grade (Includes 12th grade with no diploma)	11.15	10.72	
High School Grad/GED or Equivalent	21.64	21.49	
Some College or AA Degree	32.03	32.79	
College Graduate or Above	30.11	31.73	

Continued

Marry (%)			0.3700
Married	55.45	52.71	
Widowed	5.64	7.24	
Divorced	10.53	13.01	
Separated	2.19	2.13	
Never Married	18.58	17.17	
Living with Partner	7.60	7.74	
Smoked at Least 100 Cigarettes in Life (%)			<0.0001
Yes	43.84	56.19	
No	56.16	43.81	
Drink Alcohol ≥ 12 Cups per Year (%)			0.4760
Yes	78.47	79.89	
No	21.53	20.11	
Hypertension			<0.0001
Yes	36.86	47.32	
No	63.14	52.68	
Diabetes			0.0060
Yes	13.67	18.27	
No	86.33	81.73	
Hypercholesterolemia			0.0083
Yes	52.81	59.21	
No	47.19	40.79	
BMI	28.95 ± 6.82	29.81 ± 6.96	0.0090
MPVLR	4.40 ± 1.67	4.75 ± 1.90	<0.0001

Note: Mean ± SD for continuous variables: the P value was calculated by the weighted linear regression model; (%) for categorical variables: the P value was calculated by the weighted chi-square test. Abbreviation: BMI, body mass index; MPVLR, Mean Platelet Volume to Lymphocyte Ratio.

3.2. Association between MPVLR and PsO

Following univariate analysis, the strength of the association between MPVLR and psoriasis was assessed, and the results showed a significant association between MPVLR and psoriasis: in the unadjusted model (crude model), OR = 1.11 (95% CI: 1.05 - 1.17, P = 0.0006). In the minimally adjusted model (Model 2, adjusted for age, sex, and race), OR = 1.08 (95% CI: 1.03 - 1.15, P = 0.0067), but remained statistically significant; and remained statistically significant in the fully adjusted model (Model 3, which further included educational level, BMI, alcohol consumption, smoking, diabetes, hypertension, and abnormal cholesterol levels). These results indicate that, after adjusting for multiple covariates, a 1-unit increase in MPVLR is associated with

a 10% increase in the risk of psoriasis (OR = 1.10, 95% CI: 1.04 - 1.16, P = 0.0023), suggesting that MPVLR is independently associated with psoriasis (Table 2).

Table 2. The association between MPVLR and psoriasis.

MPVLR	OR (95% CI)	P-Value
Crude (Model 1)	1.11 (1.05, 1.17)	0.0006
Minimally Adjusted Model (Model 2)	1.08 (1.03, 1.15)	0.0067
Fully Adjusted Model (Model 3)	1.10 (1.04, 1.16)	0.0023

Model 1: unadjusted. Model 2: adjusted for age, sex, and race. Model 3: adjusted for Model 2 variables plus education level, body mass index (BMI), alcohol consumption, smoking status, diabetes, hypertension, and abnormal cholesterol levels.

3.3. Subgroup Analyses

Stratified analysis was conducted to further examine whether effect modification was present in the association between MPVLR and psoriasis (PsO) across age groups. Participants with a precise age of 40 years were included in the 40 - 59 years group, and those with a precise age of 60 years were included in the ≥60 years group. Participants over the age of 80 were included in the ≥60 years group. This was in accordance with the recommendation of the National Health and Nutrition Examination Survey (NHANES), which advocates the consolidation of ages 60 and above into a single category to minimise variations. The direction of the association remained consistent across all age groups: in individuals aged < 40 years, the association between MPVLR and PsO was not significant in the fully adjusted model (OR = 0.98, 95% CI: 0.84 - 1.13). Conversely, among individuals aged 40 - 59 years and ≥60 years, MPVLR demonstrated a positive association with psoriasis, and this correlation persisted following comprehensive adjustment (OR = 1.11, 95% CI: 1.01 - 1.21; OR = 1.12, 95% CI: 1.06 - 1.18, respectively). Concurrently, the interaction test for age stratification was non-significant (P for interaction = 0.1954 - 0.2384; using the fully adjusted model, with P = 0.2384 as a case in point), indicating that the association between MPVLR and PsO was not substantially modified by age. Older age groups primarily exhibited marginally elevated effect estimates, rather than a discernible shift in effect (Table 3).

Table 3. Subgroup analysis of the association between MPVLR and PsO.

MPVLR	Age < 40 (years)	Age 40 - 59 (years)	Age ≥ 60 (years)	P for Interaction
Crude	0.97 (0.83, 1.12)	1.09 (0.99, 1.19)	1.11 (1.05, 1.17)	0.1954
Minimally Adjusted Model (Model 2)	0.97 (0.83, 1.12)	1.08 (0.99, 1.19)	1.11 (1.05, 1.18)	0.1981
Fully Adjusted Model (Model 3)	0.98 (0.84, 1.13)	1.11(1.01, 1.21)	1.12 (1.06, 1.18)	0.2384

Model 1: unadjusted. Model 2: adjusted for age, sex, and race. Model 3: adjusted for Model 2 variables plus education level, body mass index (BMI), alcohol consumption, smoking status, diabetes, hypertension, and abnormal cholesterol levels.

3.4. Supplementary Analysis

As illustrated, the data reveal two clear inflection points in the demographic groups under consideration. The exception to this is the group of individuals under 40 years, in which no significant association was observed between MPVLR and the risk of psoriasis. Log-likelihood ratio tests indicated the presence of potential threshold effects in the 40 - 59 years and ≥60 years age groups ($P < 0.05$). However, given that the age interaction tests were not statistically significant (P for interaction = 0.2384), these age-specific inflection points should be interpreted as exploratory patterns rather than as evidence that age modifies the MPVLR-psoriasis association. In the 40 - 59 years group, below the exploratory threshold of 3.25, a one-unit increase in MPVLR was associated with a 133% increase in the risk of psoriasis; in the ≥60 years group, below the exploratory threshold of 8.46, a one-unit increase in MPVLR was associated with a 21% increase in the risk of psoriasis (Table 4).

3.5. Smoothed Curve Fitting

Figure 2 illustrates the age-stratified nonlinear associations between MPVLR and psoriasis risk, with all covariates taken into account. In the group of subjects under 40 years of age (illustrated by the red curve), no association was observed across the MPVLR range. In the 40 - 59 years group (green curve), a sharp initial rise was followed by a plateau, consistent with an inflection point at 3.25 (below which OR = 2.33, P = 0.0264). In the ≥60 years group (blue curve), a more gradual elevation was observed, consistent with an inflection point at 8.46 (below which OR = 1.21, P = 0.0001). Despite the presence of visual differences, the age-interaction test was non-significant (P = 0.2384), suggesting that these inflection points represent exploratory patterns rather than conclusive evidence of effect modification by age (Figure 2).

Table 4. Threshold effect analysis of MPVLR and Psoriasis across different age groups.

MPVLR	Age < 40 (years)	Age 40 - 59 (years)	Age ≥ 60 (years)
Risk of Developing Psoriasis			
Inflection Point	3.42	3.25	8.46
MPVLR < Inflection Point	0.77 (0.46, 1.29) 0.3236	2.33 (1.10, 4.91) 0.0264	1.21 (1.10, 1.34) 0.0001
MPVLR > Inflection Point	1.04 (0.86, 1.25) 0.7032	1.05 (0.94, 1.17) 0.4215	1.01 (0.87, 1.17) 0.9350
Log-Likelihood Ratio	0.357	0.032	0.042

4. Discussion

Research has demonstrated that the mean platelet volume-to-lymphocyte ratio (MPVLR) is associated with platelet activation, lymphocyte dysregulation, and systemic inflammatory mechanisms. However, extant research on the relationship between this marker and psoriasis in U.S. adults is limited.

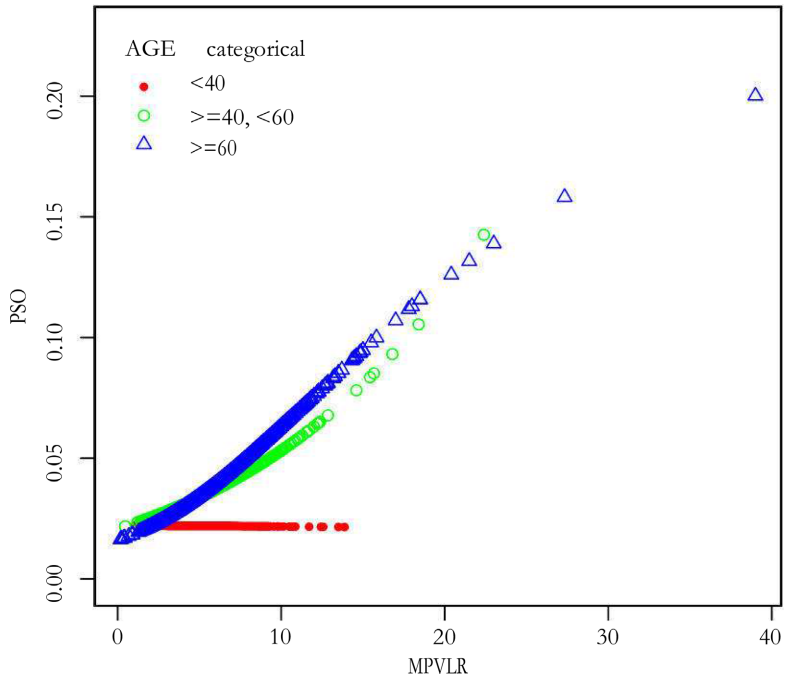

Figure 2. The nonlinear associations between MPVLR and PsO. The three age groups are indicated by different colors: red represents those under 40; green represents those aged 40 to 59; and blue represents those aged 60 and older.

In this study, data from a nationwide survey were utilised to assess the association between mean platelet volume-to-lymphocyte ratio (MPVLR) and the risk of PsO among adults in the United States. The findings of the present study suggest a positive correlation between MPVLR and the risk of psoriasis. Specifically, among adults aged 40 and older, a 1-unit increase in MPVLR was associated with a significant increase in the risk of psoriasis. The non-significant interaction tests indicate that the association between MPVLR and psoriasis does not differ significantly across age groups. Consequently, the age-specific inflection points identified in this exploratory analysis do not constitute evidence of age-specific effect modification, but rather suggest potential nonlinear patterns that warrant further investigation in future studies with larger sample sizes.

Psoriasis is a chronic inflammatory condition that is accompanied by systemic inflammation and immune imbalance. According to reports, the global prevalence of psoriasis has increased by 86% from 1990 to 2021, with an 80% increase in incidence. The number of disability-adjusted life years attributable to psoriasis has increased by 85% over the same period. It is projected that the global burden of psoriasis will continue to increase over the next 15 years [11]. In addition to causing varying degrees of skin damage, psoriasis can also lead to metabolic abnormalities, vascular disease, and a range of other comorbidities [12], significantly affecting patients' quality of life. Despite recent research efforts to identify biomarkers for psoriasis, no sensitive or specific biomarkers have yet been identified.

MPVLR is a novel research parameter that has been found to be useful in the diagnosis of systemic lupus erythematosus (SLE) and other diseases, including tu-

mours, cardiovascular disease, and renal disease. Awadh *et al.* discovered that MPVLR can be used to assess the disease activity in SLE patients and can be used as a diagnostic aid [13]. MPVLR is also a prognostic marker for some types of cancer. In patients with non-metastatic clear cell renal cell carcinoma, it can help identify high-risk patients who may need more intensive management after surgery, and is also associated with long-term survival after surgery [14]. In a prospective cohort study of 315 patients with acute ischaemic stroke, Wu *et al.* demonstrated that MPVLR is associated with the severity of stroke and is an independent predictor of short-term mortality and adverse outcomes [15]. Hudzik *et al.* further revealed that MPVLR elevation is associated with increased blood clot burden in patients with diabetes who undergo PCI for acute ischaemic stroke [16]. Kurtul *et al.* subsequently demonstrated that MPVLR is a significant independent predictor of mortality and restenosis in patients with ST-elevation myocardial infarction who undergo percutaneous coronary intervention [17]. Xu *et al.* found that MPVLR increases with renal function deterioration in patients with chronic kidney disease 1 - 4. This increase is associated with non-renal kidney disease and may help to monitor renal symptoms [18]. Diana proposed MPVLR as a low-cost, high-sensitivity indicator based on routine blood analysis. It can be used to diagnose diabetes-related renal disease in the early stages and to implement early interventions [19]. As previously stated, these diseases are associated with chronic inflammation, and MPVLR has been shown to have prognostic or predictive value in several cases. However, the extant research on the association between MPVLR and psoriasis remains inconclusive, particularly with regard to the adult population in the United States. In this study, an examination was conducted of the association between the two in a U.S. adult population, and a correlation was observed. The presence of MPVLR can be readily identified through the implementation of routine blood tests. As a widely utilised clinical biomarker, it offers numerous advantages, including high cost-effectiveness and ease of use. When combined with data on blood cells and lymphocytes, MPVLR can more accurately assess immune function and inflammatory responses. Consequently, it is anticipated that this will emerge as a promising diagnostic biomarker for psoriasis.

In addition to their well-established roles in hemostasis and thrombosis, platelets have been shown to play a pivotal role in disease progression by initiating and regulating inflammatory and immune responses [20]. Specifically, multiple cytokines work in concert to coordinate inflammation in psoriatic lesions, with the IL-23/IL-17 pathway playing a particularly critical role [21]-[23]: IL-17A primarily acts on keratinocytes, inducing the transcription of various inflammatory mediators and synergising with TNF-α to amplify the inflammatory response. Concurrently, it has been demonstrated to promote abnormal keratinocyte proliferation through indirect regulation, thereby driving pathological changes such as epidermal hyperplasia [22]. Concurrently, platelets are known to be activated upon exposure to various stimuli, including thrombin, chemokines, and microbial toxins. These cells have been found to express adhesion and immune-related receptors

on their surface, including P-selectin, CD40L, and Toll-like receptors. Furthermore, these cells have been observed to release soluble mediators, such as chemokines, cytokines, and antimicrobial peptides. It has been hypothesised that these soluble mediators interact directly or, through soluble signal-mediated synergistic effects, with endothelial cells and various types of leukocytes, including dendritic cells, T/B cells, neutrophils, monocytes, and natural killer cells [24]. In the course of this process, platelet α-granules rapidly release a variety of chemokines and serve as sources of pro-inflammatory signals within the inflammatory cascade. Concurrently, they store and release immunoregulatory molecules such as TGF-β, thereby influencing the function and immunostatic balance of monocytes/macrophages, as well as T and B cells. Moreover, platelet P-selectin promotes leukocyte adhesion and firm adhesion by binding to leukocytes and is associated with complement activation, thereby serving as a pivotal initiating step in the interaction between leukocytes and activated platelets, driving leukocyte migration along the endothelium and amplifying inflammation [25] [26]. In accordance with these mechanisms, markers of platelet activation (e.g., platelet-derived chemokines, soluble P-selectin) are elevated in the peripheral blood of psoriasis patients, and the mean platelet volume is increased, suggesting that platelets are in an activated state. Experimental studies have also demonstrated that activated platelets enhance leukocyte rolling in mouse skin, and platelet P-selectin expression in psoriasis patients increases with disease severity, suggesting that the platelet-leukocyte-endothelial axis plays a critical role in inflammatory cell recruitment and disease progression [25]. The IL-17 axis has been demonstrated to induce abnormalities in immune function, resulting in alterations in the relative numbers and functional states of lymphocyte subsets. Consequently, lymphocyte counts and their relative proportions in the blood have been identified as significant indicators of the degree of immune activation [21].

This study has several advantages. Firstly, it utilised a large and representative sample of the general adult population, and secondly, it adjusted for potential confounding factors. However, it should be acknowledged that there are several limitations. Firstly, due to the nature of the cross-sectional design, it was not possible to assess the time-related relationship between MPVLR and psoriasis. Secondly, the self-reported questionnaire used to assess the association between psoriasis and other diseases may have led to recall bias and information inaccuracy. Thirdly, MPVLR values may fluctuate over time, and it was not possible to obtain dynamic values from the database, which may have affected the analysis results. Additionally, despite adjusting for various potential confounding variables related to MPVLR and psoriasis, residual confounding factors may still be present.

5. Conclusion

In summary, the present study found that MPVLR is associated with the development of psoriasis, and this association is more pronounced in middle-aged and older adults. MPVLR has the potential to contribute to the clinical assessment of

psoriasis.

Author Contributions

All authors contributed to the article and approved the submitted version.

Ethical Statement

The portions of this study involving human participants, human materials, or human data were conducted in accordance with the Declaration of Helsinki and were approved by the NCHS Ethics Review Board. The patients/participants provided their written informed consent to participate in this study.

Data Availability

The survey data are publicly available on the internet for data users and researchers throughout the world (https://www.cdc.gov/nchs/nhanes/).

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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List of Abbreviations

MPVLR	Mean Platelet Volume to Lymphocyte Ratio
PsO	Psoriasis
NHANES	National Health and Nutrition Examination Survey
NCHS	National Center for Health Statistics
BMI	Body Mass Index
OGTT	Oral Glucose Tolerance Test
SLE	Systemic Lupus Erythematosus
IL-23	Interleukin-23
IL-17	Interleukin-17
TNF-α	Tumor Necrosis Factor-Alpha