

Serum Folate Levels and the Risk of Psoriasis: Evidence from Observational Study and Mendelian Randomization

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ABSTRACT

This study aims to investigate the relationship between serum folate levels and the risk of psoriasis by integrating observational study with Mendelian Randomization (MR) analysis. We firstly conducted an observational study using data from the National Health and Nutrition Examination Survey (NHANES). Subsequently, genetic instruments were selected for two-sample MR analyses to investigate the causal relationship between serum folate levels and the risk of psoriasis. The observational study showed no significant association between serum folate levels and psoriasis. In the fully adjusted model: serum folate as a continuous variable (OR = 0.99, 95% CI: 0.98 to 1.00, P = 0.071); serum folate quartiles Q4 vs Q1 (OR = 0.83, 95% CI: 0.58 to 1.19, P = 0.309). The MR analysis revealed that higher genetically predicted serum folate levels from Icelandic and Danish populations was significantly associated with a reduced risk of psoriasis (OR = 0.63, 95% CI, 0.45 to 0.88, P = 0.005). Similarly, higher genetically predicted serum folate levels from South Asian populations were also significantly associated with a lower risk of psoriasis (OR = 0.84, 95% CI, 0.72 to 0.98, P = 0.025). Integrating observational study with MR analysis suggests that serum folate levels are protective factors against psoriasis, indicating that higher serum folate levels may help prevent the onset of the disease.

Keywords: Folate; Psoriasis; NHANES; Mendelian Randomization

Abbreviations: MR, Mendelian randomization; NHANES, National Health and Nutrition Examination Survey; SD, standard deviation; OR, odds ratio; CI, confidence interval; IV, instrumental variables; GWAS, genome-wide association studies; IVW, inverse variance weighted.

INTRODUCTION

Psoriasis is a chronic inflammatory skin disease with systemic complications that significantly impact on patients' quality of life and mental health^(1; 2). Globally, psoriasis affects about 2% of the population, with chronic plaque psoriasis accounting for 90% of cases^(3; 4). While skin manifestations are usually the initial symptoms of psoriasis, increasing clinical and epidemiological evidence suggests a link between psoriasis and cardiovascular diseases such as stroke, coronary artery disease, and peripheral vascular disease⁽⁵⁾. Given the systemic nature of psoriasis and its links to other conditions, various biological factors have been explored. Among these, folate has garnered particular attention due to its essential role in cellular function and potential impact on the disease.

Folate is an essential water-soluble vitamin that plays a crucial role in maintaining one-carbon metabolism and deficiency in folate can negatively affect development and the nervous system⁽⁶⁾. In the context of psoriasis treatment, methotrexate—a commonly used medication^(7; 8)—can inhibit folate metabolism, potentially worsening folate deficiency and leading to adverse effects⁽⁹⁾. To mitigate these effects, folate supplementation is commonly recommended during methotrexate therapy^(10; 11), underscoring the critical role of folate in psoriasis management.

Despite folate's recognized importance, studies examining serum folate levels in psoriasis patients have yielded inconsistent results. Some studies have reported lower serum folate levels in psoriasis patients compared to healthy controls^(12; 13), while others have found no significant difference^(14; 15; 16). These inconsistencies may be due to variations in study design, sample selection, and the matching of control groups based on factors such as gender, age, race, comorbidities, and medication use. Additionally, the lower folate levels in psoriasis patients could be attributed to reverse causality, as methotrexate treatment inhibits folate metabolism⁽¹⁷⁾. A meta-analysis found that folate levels in psoriasis patients were lower than those in non-psoriasis patients⁽¹⁸⁾. However, even after conducting subgroup analyses based on psoriasis type, the presence of a healthy control group, and exposure to methotrexate, some potential confounding biases could not be entirely avoided.

Given these inconsistencies and the limitations of traditional observational study, Mendelian randomization (MR) provides a robust approach to address the gaps in

understanding the causal relationship between folate levels and psoriasis risk. MR uses genetic variations, particularly SNPs, as instrumental variables (IVs) to infer potential causal relationships between exposures and outcomes⁽¹⁹⁾. This method offers more reliable causal inferences than traditional epidemiological studies, especially in the presence of confounding factors and reverse causality⁽²⁰⁾.

Building on the above background, we designed this study to systematically explore the relationship between serum folate levels and psoriasis. First, we conducted an observational analysis using data from the National Health and Nutrition Examination Survey (NHANES) to examine the association between serum folate levels and psoriasis risk. Subsequently, we conducted a two-sample MR analysis to investigate whether genetically predicted serum folate levels have a causal effect on psoriasis onset.

METHODS

Observational Study

Data Selection and Study Design

Our study was based on the NHANES database. All NHANES protocols were approved by the NCHS Research Ethics Review Board, and informed consent was obtained from all participants. The detailed design and data from the NHANES study are publicly available at the following website: (<https://www.cdc.gov/nchs/nhanes/index.htm>). We extracted data from five NHANES cycles (2003-2004, 2005-2006, 2009-2010, 2011-2012, and 2013-2014). The exclusion criteria were as follows: (1) missing psoriasis diagnosis data, (2) age under 20 years, (3) missing serum folate data, (4) pregnant women, and (5) missing values for other covariates. A total of 16773 participants were included in the final analysis (Supplementary Figure 1). We selected the Mobile Examination Center (MEC) weights, calculated as $1/5 \times \text{WTMEC2YR}$.

Assessment of serum folate

From 2003 to 2006, serum folate was measured using the Bio-Rad Laboratories "Quantaphase II Folate" radioassay kit; In 2009-2010, it was measured by microbiological assay; and from 2011 to 2014 by isotope-dilution high-performance liquid chromatography coupled to tandem mass spectrometry. Since previous studies have suggested that the

microbiologic assay is the most accurate among these methods, we used fractional polynomial regression to convert serum folate values from 2003-2006 to equivalent values from 2009-2014⁽²¹⁾. Detailed specimen collection and processing procedures are outlined in the NHANES Laboratory Procedures Manual (<https://www.cdc.gov/nchs/nhanes/index.htm>). Vials were stored frozen (-20°C) until shipment to the National Center for Environmental Health for testing.

Assessment of Psoriasis

Participants were defined as having psoriasis if they answered "Yes" to either of the following questions: "Have you ever been told by a health care provider that you had psoriasis?" or "Have you ever been told by a doctor or other health care professional that you had psoriasis (sore-eye-asis)?" Participants who refused to answer or responded with "Don't know" were excluded⁽²²⁾.

Covariates

The covariates in our study that may affect the psoriasis include age (20-60, ≥60 years old), sex (male, female), education level (under high school, high school or equivalent, college graduate or above), race/ethnicity (White, Black, Mexican American, Other), poverty income ratio (PIR) (<1.3, 1.3-3.5, ≥3.5), body mass index (BMI) (<18.5, 18.5-25, 25-30, ≥30), hypertension (no, yes), diabetes (no, yes), smoking status (never, ever, current), alcohol use (no, yes) and dietary folate intake (insufficient intake, adequate intake, excessive intake).

Statistical Analysis

Serum folate levels were analyzed as a continuous variable or categorized into quartiles, with the first quartile (Q1) representing the lowest levels and the fourth quartile (Q4) representing the highest levels. Considering the complex multistage sampling design of NHANES, we strictly followed the NHANES analysis guidelines⁽²³⁾. Continuous variables were presented as means with standard deviations (SDs), while categorical variables were presented as percentages. Comparisons between different groups were conducted using the Chi-square test for categorical variables and the *t*-test for continuous variables. The association between psoriasis and serum folate levels was analyzed using weighted multivariable logistic regression models. In addition, we considered serum folate levels exceeding 1.5 times the third quartile as outliers and excluded them for sensitivity analysis to verify the stability of

the results. Four models were used: the crude model, which did not adjust for covariates; Model 1, which adjusted for age and sex; Model 2, which adjusted for age, sex, race/ethnicity, education level, and PIR; and Model 3, which adjusted for all covariates. The odds ratio (OR) and 95% confidence intervals (CIs) were used to estimate the strength of the association in the multivariable models. All analyses were conducted using R version 4.4.1.

MR-Analysis

Selection of Instrumental Variables

Genetic data for serum folate were obtained from a genome-wide association study (GWAS) involving 37,341 individuals from Iceland and Denmark⁽²⁴⁾. Specifically, the sample size was 28,913 from Iceland and 8,428 from Denmark. In the preliminary analysis, we selected three genome-wide significant SNPs ($P < 5 \times 10^{-8}$) as IVs for serum folate (rs1801133, rs652197, rs17421511). Detailed information on the serum folate SNPs can be found in Supplementary Table 1. Additionally, we excluded one SNP (rs17421511) from further analysis based on the instrumental variable (IV) inclusion threshold ($r^2 > 0.001$) used in the MR analysis. We then calculated the F -statistic to assess the strength of the IVs, which helps detect weak instrument variable problems and improves the reliability and statistical power of the analysis. The F -statistics for serum folate met the MR analysis assumption of $F > 10$ (Supplementary Table 1)⁽²⁵⁾.

To avoid population source limitations, we also selected serum folate genetic data from a GWAS involving 38,000 individuals of South Asian descent for sensitivity analysis⁽²⁶⁾. We selected SNPs with genome-wide significance ($P < 5 \times 10^{-8}$) and independence ($r^2 = 0.001$). A total of 6 SNPs were selected, with five new SNPs (rs116949171, rs61930974, rs74794636, rs1893007, rs12367973) in addition to rs1801133, which was previously mentioned. Detailed information on the serum folate SNPs can be found in Supplementary Table 2.

Outcome Data Source

Genetic data for psoriasis were obtained from a GWAS involving 44,161 individuals of European ancestry, including 15,967 psoriasis patients and 28,194 controls (<https://gwas.mrcieu.ac.uk/>) (ID: ebi-a-GCST90019016)⁽²⁷⁾. The study also conducted a genome-wide association study (GWAS) of psoriasis in South Asians, including 2,590 cases

and 1,720 controls⁽²⁷⁾.

Statistical Analysis

Inverse variance weighting (IVW) based on fixed-effect and random-effect models was used as the primary analysis method⁽²⁸⁾. Cochran's Q statistic was employed to assess heterogeneity among individual SNPs⁽²⁹⁾. We also performed sensitivity analyses using the weighted median method and the MR-Egger method to verify the robustness of our results^(30; 31). The intercept obtained from MR-Egger regression was used to measure directional pleiotropy⁽³²⁾. To address potential measurement error in the SNP-exposure effect, the maximum likelihood method was applied to provide more reliable estimates⁽³³⁾. Additionally, single-SNP analysis was conducted to evaluate the independent contribution of each SNP to the exposure-outcome relationship. The leave-one-out method was implemented by sequentially excluding each SNP to determine whether the estimates were driven by any single SNP. All analyses were performed using R version 4.4.1 and the "TwoSampleMR" package.

RESULTS

Observational Analysis Results

In the definition of psoriasis, 27 participants refused to answer the questions or responded with "don't know." A total of 16773 participants were included in this study, with 50.41% being male and 49.59% female. Among them, 466 participants (2.78%) were diagnosed with psoriasis. There were significant differences in age, race, BMI, smoking and hypertension prevalence between psoriasis and non-psoriasis patients. Detailed demographic characteristics are presented in Table 1.

After performing weighted multivariable logistic regression analysis (Table 2), our results indicated that no significant association between serum folate levels and psoriasis in our crude model (OR = 1.00, 95% CI, 0.99 to 1.01, P = 0.429), Model 1 (OR = 0.99, 95% CI, 0.98 to 1.00, P = 0.081), Model 2 (OR = 0.99, 95% CI, 0.98 to 1.00, P = 0.029), and Model 3 (OR = 0.99, 95% CI, 0.98 to 1.00, P = 0.071). The results were similar when serum folate was analyzed as a categorical variable. Comparing the highest quartile (Q4) with the lowest quartile (Q1), the association remained non-significant across the crude model (OR = 0.99,

95% CI, 0.71 to 1.38, $P = 0.937$), Model 1 (OR = 0.87, 95% CI, 0.62 to 1.24, $P = 0.438$), Model 2 (OR = 0.79, 95% CI, 0.56 to 1.12, $P = 0.184$), and Model 3 (OR = 0.83, 95% CI, 0.58 to 1.19, $P = 0.309$).

We considered serum folate levels exceeding 34.65 ng/mL (1.5 times the third quartile value) as outliers. After excluding 1317 outlier samples, a sensitivity analysis was performed. The results showed no significant association between elevated serum folate levels and a reduced risk of psoriasis. In the fully adjusted model: serum folate as a continuous variable (OR = 0.99, 95% CI: 0.97 to 1.01, $P = 0.205$); serum folate quartiles Q4 vs Q1 (OR = 0.81, 95% CI: 0.57 to 1.14, $P = 0.219$). Detailed results are presented in Supplementary Table 3.

MR Analysis Results

The effect estimates from the MR analysis examining the association between serum folate levels and psoriasis are illustrated in Figure. For the MR analysis of serum folate (Iceland and Denmark) and psoriasis, Cochran's Q test found no evidence of heterogeneity ($P > 0.05$), so the fixed-effects IVW model was chosen for the MR analysis. The IVW method indicated that higher genetically predicted serum folate levels was associated with a reduced risk of psoriasis (OR = 0.73, 95% CI, 0.53 to 1.00, $P = 0.049$). Sensitivity analyses confirmed similar results. The weighted median method showed an OR of 0.75 (95% CI, 0.56 to 1.00, $P = 0.047$), and the maximum likelihood method yielded an OR of 0.73 (95% CI, 0.56 to 0.95, $P = 0.019$). MR-Egger regression found no evidence of directional pleiotropy ($P > 0.05$).

After excluding one SNP due to linkage disequilibrium, the association between serum folate levels and psoriasis remained consistent with the preliminary results. Higher genetically predicted serum folate levels was associated with a reduced risk of psoriasis, as shown by both IVW method (OR = 0.63, 95% CI, 0.45 to 0.88, $P = 0.005$) and the maximum likelihood method (OR = 0.63, 95% CI, 0.45 to 0.88, $P = 0.006$). Due to the requirement of at least three SNPs for MR-Egger regression, we were unable to assess horizontal pleiotropy using this method. Single SNP analysis revealed that both serum folate SNPs act as protective factors against psoriasis (Supplementary Figure 2A).

For the MR analysis of serum folate (South Asian) and psoriasis (European), Cochran's Q test found no evidence of heterogeneity ($P > 0.05$). The IVW method indicated that higher

genetically predicted serum folate levels was associated with a reduced risk of psoriasis (OR = 0.84, 95% CI, 0.72 to 0.98, $P = 0.025$). The weighted median method showed an OR of 0.82 (95% CI, 0.68 to 0.97, $P = 0.024$), The MR-Egger method showed an OR of 0.60 (95% CI, 0.31 to 1.14, $P = 0.192$), and the maximum likelihood method yielded an OR of 0.84 (95% CI, 0.71 to 0.98, $P = 0.026$). MR-Egger regression found no evidence of directional pleiotropy ($P > 0.05$). The results of the single SNP analysis are shown in Supplementary Figure 2B. The leave-one-out analysis plot (Supplementary Figure 3) showed that, except for SNP rs1801133, which had a certain impact on the results, no potentially influential SNPs affected the causal relationship.

Additionally, we explored available Asian psoriasis GWAS data (2,590 cases/1,720 controls). Analysis with this dataset showed similar trends to our main findings, though results weren't statistically significant due to limited sample size and matched SNPs (only three). The effect estimates were: IVW method (OR = 0.59, 95% CI: 0.24 to 1.47, $P = 0.258$), weighted median (OR = 0.55, 95% CI: 0.28 to 1.08, $P = 0.073$), and maximum likelihood (OR = 0.59, 95% CI: 0.33 to 1.05, $P = 0.074$).

DISCUSSION

Our observational study found no significant association between serum folate levels and psoriasis. This lack of association may be due to the relatively small sample size of psoriasis patients (2.78% of participants) in our NHANES dataset. In contrast, the MR analysis indicated a significant causal relationship between serum folate and the risk of psoriasis, identifying serum folate levels as a protective factor. To our knowledge, this is the first study to investigate the causal relationship between serum folate and psoriasis.

Previous studies have mainly focused on whether there is a significant difference in serum folate levels between psoriasis and non-psoriasis populations, but the results have been inconsistent. Seven studies^(12; 13; 34; 35; 36; 37; 38) reported significantly lower serum folate levels in psoriasis patients, which differs from our observational study findings. Several factors may explain this discrepancy: first, differences in sample sizes—many previous studies were small case-control studies, while our observational study involved a larger sample; second, variations in sample quality control—four studies^(12; 13; 36; 38) strictly controlled sample

selection, including healthy controls and excluding patients who had been exposed to methotrexate, as both disease factors and methotrexate use could affect serum folate levels. Our study, due to its large sample size and inability to fully control for other diseases and medications, may have been influenced by these factors. On the other hand, four studies^(14; 15; 16; 39) found no significant difference in serum folate levels between the case and control groups, consistent with our observational study results. These studies also differed in sample size and drug control. Additionally, different age groups, ethnic populations, and gender compositions may also have an impact on the results.

Our MR analysis suggests that serum folate levels is a protective factor against psoriasis, this is consistent with the trend observed in our observational study. MR studies can significantly reduce the influence of confounding factors and reverse causation, effectively addressing the limitations of observational study. Although recent MR studies have explored the association between serum folate levels and other autoimmune diseases⁽⁴⁰⁾, the causal relationship between serum folate levels and psoriasis has not been thoroughly investigated. Our study fills this gap by providing the first evidence of this relationship, using rigorously selected instrumental variables and considering potential limitations such as ethnicity. These methods help ensure the accuracy of causal inference and reduce possible biases. This finding supports the hypothesis that higher serum folate levels may help prevent the onset of psoriasis. However, to confirm these findings and establish the optimal dosage and duration, further investigation through large-scale cohort studies or randomized controlled trials (RCTs) is required.

Folate exerts its protective effects against psoriasis may through several biological mechanisms. First, folate is a precursor to the methyl donor S-adenosylmethionine, which plays a critical role in DNA methylation. DNA methylation is a key epigenetic regulatory mechanism that regulates gene expression and can suppress the abnormal activation of genes associated with psoriasis^(41; 42). By maintaining proper DNA methylation patterns, folate may help prevent the excessive proliferation of skin cells characteristic of psoriasis. Second, folate deficiency can impair cell division and growth⁽⁴³⁾, leading to abnormal proliferation of skin cells, which is a hallmark of psoriasis. Furthermore, folate plays an important role in maintaining immune system balance; a lack of folate can damage dendritic cell function,

affecting Th cell differentiation and response⁽⁴⁴⁾, potentially exacerbating the inflammatory processes involved in psoriasis. Lastly, antioxidant properties of folate may help alleviate psoriasis symptoms by reducing oxidative damage through decreased free radical production⁽⁴⁵⁾. These biological mechanisms support that folate is a rational and consistent protective factor for psoriasis. Given that folate cannot be synthesized in the body and must be obtained through diet, folate supplementation may be significant in preventing or alleviating psoriasis. Future research should explore the long-term effects of folate supplementation on psoriasis outcomes.

This study has several strengths. We initially conducted an observational study using the NHANES database to investigate the association between serum folate levels and psoriasis incidence. This large cross-sectional study benefits from NHANES' multi-stage complex sampling design, which plays a crucial role in ensuring the representativeness and accuracy of the survey results. Subsequently, we utilized MR analysis to explore the causal relationship between serum folate levels and psoriasis. By employing these methods, our study provides a comprehensive examination of the relationship between serum folate levels and psoriasis. The MR analysis helps mitigate biases related to confounding factors and reverse causation, addressing the limitations of the observational study.

However, our study also has several limitations. Firstly, the data on psoriasis patients in the observational study were collected via self-report, and the number of psoriasis patients included in the study was relatively small. Additionally, we were unable to determine whether the study participants were using medications or other factors that might influence serum folate levels, which could introduce bias into the analysis. Secondly, the MR study was constrained by a limited number of SNPs related to serum folate levels, particularly for the European population, weakening the robustness of the causal inference. Caution is therefore advised when interpreting these MR results. Future studies, utilizing larger datasets, are essential to further investigate and confirm the relationship.

CONCLUSIONS

In summary, our MR study suggests that serum folate levels is a protective factor against psoriasis, and higher serum folate levels may help prevent the onset of psoriasis. However,

due to the limitations of the studies and other constraints, these associations warrant further investigation. Nonetheless, considering that folate supplementation may reduce the side effects of methotrexate treatment for psoriasis, we recommend that psoriasis patients consider appropriate folate supplementation.

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Author contributions

Chang-Jie Du and Rui-Xue Leng conceived, designed, and planned the study. Chang-Jie Du, Jian-Wen Ye, and Yuan-Chen Zhao acquired and analyzed the data. Chang-Jie Du, Jian-Wen Ye, Dong-Sheng Di and Rui-Xue Leng interpreted the results. Chang-Jie Du drafted the manuscript. Dong-Sheng Di and Rui-Xue Leng contributed to the critical revision of the manuscript and supervised the study. All authors read and approved the final manuscript.

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DECLARATIONS

Conflict of interest

The authors declare that they have no conflict of interest.

Ethics approval

The datasets used in this study are publicly accessible and were obtained from sources that have received ethical approval from their respective ethics committees. Additionally, this study adhered to the principles outlined in the Declaration of Helsinki.

Consent for publication

Not applicable.

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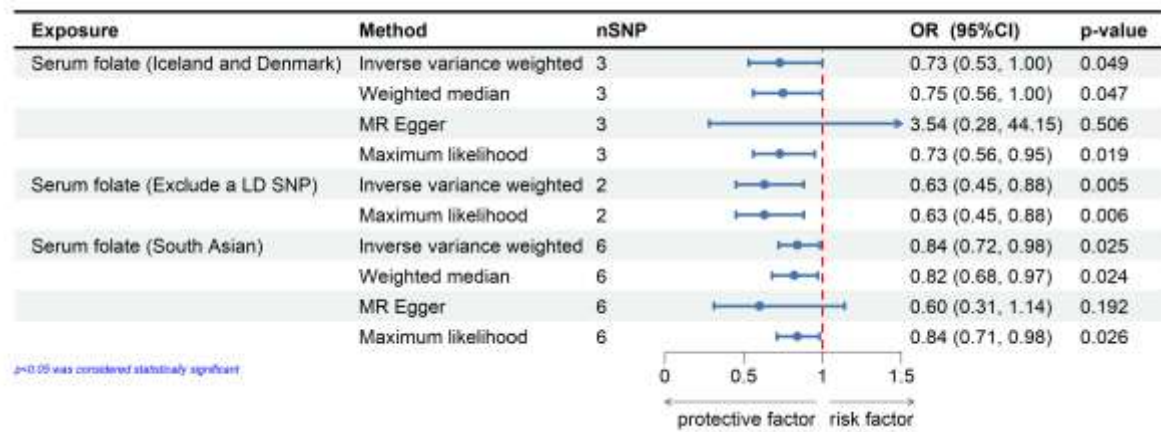


Figure 1. Forest plot of the MR analysis. The MR shows that higher genetically predicted serum folate levels was associated with a reduced risk of psoriasis. LD, linkage disequilibrium; SNP, single nucleotide polymorphism; OR, odds ratio; CI, confidence interval

Table 1. Baseline demographic characteristics of NHANES 2003-2006 and 2009-2014.

Characteristics	Total (N=16773)	Without Psoriasis (N = 16307)	With Psoriasis (N = 466)	P-value
Age, mean (SD)	46.08 (16.73)	46.02 (16.77)	49.14 (15.85)	<0.001
Age, n (%)				0.084
20 - 60	12887 (76.83)	12545 (76.93)	342 (73.39)	
≥60	3886 (23.17)	3762 (23.07)	124 (26.61)	
Sex, n (%)				0.243
Male	8456 (50.41)	8234 (50.49)	222 (47.64)	
Female	8317 (49.59)	8073 (49.51)	244 (52.36)	
Race, n (%)				<0.001
White	7982 (47.59)	7686 (47.13)	296 (63.52)	
Black	3509 (20.92)	3449 (21.15)	60 (12.88)	
Mexican American	2529 (15.08)	2495 (15.30)	34 (7.30)	
Other	2753 (16.41)	2677 (16.42)	76 (16.31)	
Education level, n (%)				0.068
Under high school	3663 (21.84)	3581 (21.96)	82 (17.60)	
High school or equivalent	3821 (22.79)	3714 (22.78)	107 (22.96)	
College graduate or above	9289 (55.38)	9012 (55.26)	277 (59.44)	
PIR, n (%)				0.085
<1.3	5190 (30.94)	5034 (30.87)	156 (33.48)	
1.3-3.5	6034 (35.97)	5889 (36.11)	145 (31.12)	
≥3.5	55.49 (33.08)	5384 (33.02)	165 (35.41)	
BMI, n (%)				<0.001
<18.5	259 (1.54)	257 (1.58)	2 (0.43)	

18.5-25	4783 (28.52)	4686 (28.74)	97 (20.82)	
25-30	5527 (32.95)	5364 (32.89)	163 (34.98)	
≥30	6204 (36.99)	6000 (36.79)	204 (43.78)	
Diabetes, n (%)				0.086
No	14967 (89.23)	14563 (89.31)	404 (86.70)	
Yes	1806 (10.77)	1744 (10.69)	62 (13.30)	
Smoking, n (%)				<0.001
Never	9155 (54.58)	8949 (54.88)	206 (44.21)	
Ever	3790 (22.60)	3642 (22.33)	148 (31.76)	
Current	3828 (22.82)	3716 (22.79)	112 (24.03)	
Hypertension, n (%)				<0.001
No	11406 (68.00)	11140 (68.31)	266 (57.08)	
Yes	5367 (32.00)	5167 (31.69)	200 (42.92)	
Alcohol use, n (%)				0.417
No	4358 (25.98)	4245 (26.03)	113 (24.25)	
Yes	12415 (74.02)	12062 (73.97)	353 (75.75)	
Dietary folate intake, n (%)				0.881
Insufficient intake	9859 (58.78)	9588 (58.79)	271 (58.15)	
Adequate intake	6437 (38.38)	6254 (38.35)	183 (39.27)	
Excessive intake	478 (2.85)	466 (2.86)	12 (2.58)	

SD, standard deviation; PIR, poverty income ratio; BMI, body mass index.

Alcohol use, "Had at least 12 alcohol drinks in 1 year?" If the answer is "No," then alcohol use is classified as "NO"; if the answer is "Yes," then alcohol use is classified as "YES."

Dietary folate intake, Insufficient intake: Less than 400 micrograms; Adequate intake: Greater than or equal to 400 micrograms but less than 1000 micrograms; Excessive intake: Greater than 1000 micrograms.

Table 2. Weighted multifactorial logistic analysis of serum folate levels and psoriasis.

	Crude model		Model 1		Model 2		Model 3	
	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Serum Folate	1.00 (0.99, 1.01)	0.429	0.99 (0.98, 1.00)	0.081	0.99 (0.98, 1.00)	0.029	0.99 (0.98, 1.00)	0.071
Quartiles of Serum Folate								
Q1	ref		ref		ref		ref	
Q2	0.97 (0.73, 1.29)	0.843	0.95 (0.72, 1.27)	0.748	0.93 (0.70, 1.25)	0.647	0.94 (0.70, 1.26)	0.657
Q3	0.83 (0.61, 1.13)	0.240	0.81 (0.59, 1.10)	0.180	0.76 (0.55, 1.04)	0.088	0.78 (0.56, 1.07)	0.122
Q4	0.99 (0.71, 1.38)	0.937	0.87 (0.62, 1.24)	0.438	0.79 (0.56, 1.12)	0.184	0.83 (0.58, 1.19)	0.309

OR, odds ratio; CI, confidence interval. Model 1 was adjusted for age and sex; Model 2 was adjusted for age, sex, race/ethnicity, education level, and PIR; Model 3 was adjusted for age, sex, race/ethnicity, education level, poverty income ratio, body mass index, diabetes, smoking, hypertension, alcohol use and dietary folate intake.