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ORIGINAL RESEARCH

Weight-Adjusted Waist Index, Psoriasis, and All-Cause Mortality: Findings from the NHANES 2003–2006 and 2009–2014

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Purpose: Psoriasis is associated with obesity, which in turn is linked to increased mortality risk. Therefore, we undertook a cohort study utilizing data from the National Health and Nutrition Examination Survey (NHANES) to examine the impact of weight-adjusted waist index (WWI) on the likelihood of all-cause mortality in psoriasis individuals.

Patients and Methods: This study utilized data from the National Health and Nutrition Examination Survey (NHANES) to investigate the influence of WWI on the probability of all-cause mortality in psoriasis individuals. A retrospective cohort analysis included 19,919 participants aged 18 to 80 years, with or without psoriasis. The primary endpoint studied was all-encompassing mortality up to December 2019. The interplay between WWI and psoriasis was analyzed through multivariable logistic regression techniques. Survival probabilities were assessed employing Kaplan-Meier curves and Cox regression analyses.

Results: Out of the 19,919 subjects that we eventually included, 522 had psoriasis. Psoriasis and WWI were found to be significantly positively correlated. A significant correlation was found between an incremental unit increase in WWI and a 63% increased risk of all-cause mortality risk in psoriasis patients (HR = 1.63, 95% CI 1.02–2.61). Subgroup analyses demonstrated consistent findings within the psoriasis population. These findings suggest an independent impact of WWI on psoriasis risk and mortality.

Conclusion: Our investigation revealed that there is a strong positive correlation between WWI and all-cause mortality in US psoriasis adults. For those with psoriasis, managing WWI, or obesity, is crucial.

Keywords: psoriasis, obesity, WWI, all-cause mortality, NHANES

Introduction

Psoriasis is a common dermatological disorder in which patients are plagued by recurring red spots, scales, and itching. It has a high incidence, tendency for recurrence, and prolonged duration.[1] According to epidemiological data, approximately 3.6% of adults in the US are affected by psoriasis, with a perceptible escalating trajectory over successive years.[2] While the complete etiology of psoriasis remains under investigation, with genetic, immune, infectious, and endocrine factors all potentially playing a role, the pathogenesis is increasingly understood to involve a dysregulated immune response, particularly involving the Th17 pathway and characterized by key inflammatory cytokines such as IL-23, IL-17, and TNF-alpha, driving the characteristic inflammation seen in this disease.[3] Previous studies have suggested that psoriasis may be directly linked to an elevated risk of death.[4]

Obesity is a complex chronic metabolic condition marked by the superset body fat, which can have numerous negative health effects and increase the risk of death.[5] The morbidity of obesity is notably rising and is now a critical public health situation.[6] In healthcare settings, one of the most popular metrics for evaluating obesity is BMI, but it cannot distinguish changes in fat distribution and has certain limitations in assessing "general obesity".[7] Park introduced a new overweight indicator: the weight-adjusted waist index (WWI), which assesses obesity based on the weight of

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a standardized waist circumference (WC), and found that this indicator has good predictive function for cardiovascular disease, cardiometabolic disease, and mortality from all causes.[8]

Obesity is linked to a variety of skin conditions, including psoriasis.[9,10] The association them has garnered attention in the medical research community due to mounting evidence suggesting that obesity may exacerbate the clinical course of psoriasis as a potential risk factor.[9,11,12] The identification of a shared inflammatory pathway involving cytokines suggests that the bi-directional correlation is biologically plausible.[13,14]

Indeed, both psoriasis and obesity have been implicated in heightened susceptibility to mortality.[4,5,15] As a new anthropometric index, WWI has been validated by two studies, establishing its correlation with psoriasis.[16,17] However, the relationship between this indicator and the risk of death in psoriasis individuals is unknown. We used data from the National Health and Nutrition Examination Survey (NHANES) for the years 2003–2006 and 2009–2014 to investigate the influence of WWI on the probability of all-cause mortality in psoriasis patients. Additionally, we expanded our research scope to ascertain if this correlation exists among individuals without psoriasis, as well as to evaluate whether the WWI acts as a prognosticator of total cause of death.

Materials and Methods

Study Design and Population

The NHANES program is a prestigious, nationally inclusive survey effort orchestrated by the National Center for Health Statistics (NCHS). The research methodologies have garnered approval from the NCHS Research Review Committee for Ethics, and written consent was initially given by each participant. In this retrospective cohort investigation, we acquired and scrutinized the data for the years 2003–2006 and 2009–2014, encompassing exhaustive information such as body measurement metrics and the prevalence of psoriasis. The NHANES cycle of 2007 to 2008 was excluded owing to the lack of data pertaining to psoriasis. To guarantee the accuracy and dependability of the data, we included 50,938 individuals during the survey cycles spanning 2003–2006 and 2009–2014. We excluded 16,459 participants who were missing measurements for weight and waist circumference, along with 11,570 participants who did not complete the psoriasis questionnaire. Additionally, 2,990 participants were excluded due to unavailability of mortality data or because they were under the age of 18. Ultimately, the final sample encompassed individuals aged 18 to 80 years, comprising 19,919 participants (Figure 1).

Assessment of WWI and Psoriasis

WWI was calculated using the following formula: (WC(cm))/√(Weight(kg)).[8] At the Mobile Examination Center (MEC), participants' waist circumference and weight were evaluated and documented by certified professionals employing a uniform, standardized methodology. Weight measurements were taken with individuals removing their shoes and heavy garments. Prior to the examination, individuals disrobe heavy attire and footwear to ensure full exposure. The presence of psoriasis was ascertained through the utilization of a questionnaire: "Ever been told you have psoriasis?" The intensity of psoriasis was evaluated based on responses to the query, "What is the current severity of your psoriasis?" Participants were given the option to classify their condition as (1) little or no psoriasis; (2) only a few patches; (3) scattered patches; or (4) extensive psoriasis.[18] This self-reported assessment of psoriasis severity is inherently subjective and lacks the objectivity of clinical measures such as the Psoriasis Area and Severity Index (PASI) or physician global assessments. Consequently, the findings regarding psoriasis severity may be subject to recall bias and underestimation of the true severity.

All-Cause Mortality

We obtained mortality data from National Death Index (NDI) records and correlated them with the NHANES dataset for the corresponding years. Continued Follow-up was executed from the survey date until the participants' demise for various reasons or until December 31, 2019.

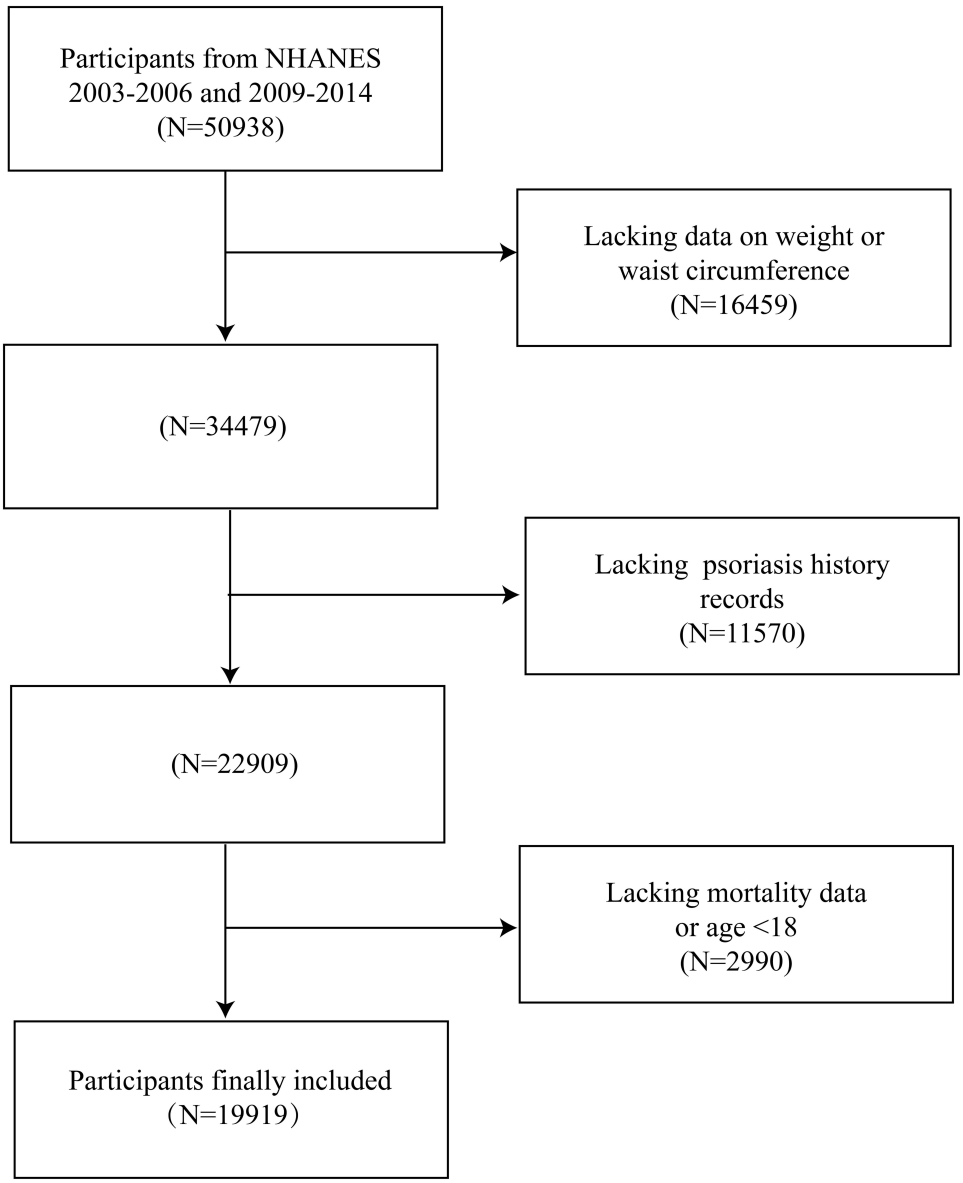

Figure 1 Flowchart of the study population.

Inclusion of Covariates

Drawing upon prior research, we incorporated a spectrum of covariates that may influence the study's outcomes, including sociodemographic information, educational level (categorized as less than high school, high school, and college or above), marital status, ratio of family income to poverty(PIR), blood lipid levels, tobacco and alcohol consumption, physical activity, the degree of psoriasis, and co-occurrence of underlying conditions such as hypertension, diabetes, and cardiovascular disease (CVD). Participants were classified into categories of current smokers, former smokers, and never smokers based on the smoking questionnaires (SMQ020 and SMQ040).[19] Participants who reported the consumption of a minimum of 12 alcoholic beverages within a year were categorized as alcohol consumers. Physical activity was measured according to the questionnaire: "In a typical week do you do any moderate-intensity sports, fitness, or recreational activities for at least 10 minutes continuously?" Hemoglobin levels ≥6.5 or a clinical diagnosis of diabetes from a medical practitioner are indicators of the condition's existence.[20] The participant's high blood pressure status was determined using the hypertension questionnaire (BPQ020). CVD was assessed via a questionnaire that asked participants,

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Has a doctor or other health professional ever told you that you have angina pectoris, congestive heart failure, coronary heart disease, heart attack, or stroke?[21]

Statistical Analysis

Based on the existence or lack of psoriasis and WWI trisection, the subjects were methodically categorized. Subsequently, a concise summary of the baseline clinical and demographic feature of the objects was provided. Mean ± standard deviation is used to represent continuous variables, and percentage is used to represent the proportion of categorical variables. Multivariate logistic regression analysis was employed to investigate the linear association between WWI and psoriasis. Three models were formulated to account for possible confusing factors, with Model 1 as the sole independent variable WWI; Model 2 included demographic variables such as sex, age, and race; Model 3 additionally included education level, marital status, PIR, smoking status, alcohol drinking status, diabetes status, CVD, hypertension, total cholesterol, and LDL-C. The hazard ratio (HR) of mortality from all causes linked to WWI in both psoriatic and non-psoriatic people (the latter as an extra analysis) was also estimated using multivariate Cox regression. Subgroup analyses were conducted within cohorts characterized by varying sex, age, and disease status, and an analysis of their interactions was also conducted. We also perform a trend test to evaluate the robustness after classifying WWI as a trisection. All statistical analyses were conducted using R software version 4.3.1 and Empowerstats version 2.0.

Results

Baseline Characteristics

Ultimatly, 19,919 patients aged 18 years and older (regardless of their history of psoriasis) were included in the analysis, consisting of 9,652 men (48.46%) and 10,267 women (51.54%), with a mean (SD) age of 45.58 (17.74) years. There were 522 patients (2.62%) among them had been told that they had psoriasis (Table 1). Over 101 months on average of the follow-up period, 1,678 participants died of various causes, 64 of whom had psoriasis. Among all

Table 1 Baseline Characteristics of Psoriatic Individuals Based on WWI Trisection

	T1 (N= 133)	T2 (N=176)	T3 (N=213)	P value
Age, years old	39.05 ± 13.87	47.64 ± 14.54	58.82 ± 14.90	<0.001
WWI	10.06 ± 0.41	10.96 ± 0.21	11.96 ± 0.46	<0.001
Total cholesterol (mmol/L)	4.87 ± 0.96	5.16 ± 1.13	5.04 ± 1.06	<0.001
Low-density lipoprotein (mmol/L)	2.84 ± 0.60	2.92 ± 0.64	2.94 ± 0.63	0.496
Gender				0.014
Male, n%	65 (48.87%)	97 (55.11%)	86 (40.38%)	
Female, n%	68 (51.13%)	79 (44.89%)	127 (59.62%)	
Race/Ethnicity				0.016
Mexican American	8 (6.02%)	7 (3.98%)	29 (13.62%)	
Other Hispanic	10 (7.52%)	18 (10.23%)	19 (8.92%)	
Non-Hispanic White	82 (61.65%)	110 (62.50%)	119 (55.87%)	
Non-Hispanic Black	21 (15.79%)	16 (9.09%)	26 (12.21%)	
Other Race - Including Multi-Racial	12 (9.02%)	25 (14.20%)	20 (9.39%)	

(*Continued*)

Table 1 (Continued).

	T1 (N= 133)	T2 (N=176)	T3 (N=213)	P value
Education level				<0.001
Less than high school	19 (14.73%)	24 (13.87%)	61 (28.64%)	
High school or equivalent	22 (17.05%)	38 (21.97%)	57 (26.76%)	
College or above	88 (68.22%)	111 (64.16%)	95 (44.60%)	
Marital status				<0.001
Married	65 (50.39%)	97 (56.07%)	104 (48.83%)	
Widowed	3 (2.33%)	9 (5.20%)	25 (11.74%)	
Divorced	11 (8.53%)	22 (12.72%)	34 (15.96%)	
Separated	3 (2.33%)	7 (4.05%)	16 (7.51%)	
Never married	37 (28.68%)	20 (11.56%)	21 (9.86%)	
Living with partner	10 (7.75%)	18 (10.40%)	13 (6.10%)	
PIR				<0.001
<1.3	38 (30.40%)	38 (23.60%)	83 (42.35%)	
1.3–3.5	33 (26.40%)	56 (34.78%)	66 (33.67%)	
>3.5	54 (43.20%)	67 (41.61%)	47 (23.98%)	
Smoking				0.086
Now	29 (22.14%)	43 (24.86%)	46 (21.60%)	
Past	34 (25.95%)	62 (35.84%)	83 (38.97%)	
Never	68 (51.91%)	68 (39.31%)	84 (39.44%)	
Drinking				0.066
Yes	100 (81.97%)	132 (79.04%)	143 (71.50%)	
No	22 (18.03%)	35 (20.96%)	57 (28.50%)	
Moderate activity				<0.001
Yes	69 (51.88%)	94 (53.41%)	74 (34.74%)	
No	64 (48.12%)	82 (64.59%)	139 (65.26%)	
Hypertension				<0.001
Yes	23 (17.29%)	57 (32.39%)	103 (48.36%)	
No	77 (57.89%)	87 (49.3%)	37 (17.37%)	
Diabetes				<0.001
Yes	5 (3.76%)	20 (11.36%)	62 (29.11%)	
No	128 (96.24%)	156 (88.64%)	151 (70.89%)	
Cardiovascular disease				<0.001
Yes	8 (6.02%)	18 (10.23%)	53 (24.88%)	

(*Continued*)

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Table 1 (Continued).

	T1 (N= 133)	T2 (N=176)	T3 (N=213)	P value
No	125 (93.98%)	158 (89.77%)	160 (75.12%)	
Degree of psoriasis				0.373
Mild	74 (82.22%)	103 (83.06%)	105 (76.64%)	
Moderate-to-severe	16 (17.78%)	21 (16.94%)	32 (23.36%)	

Notes: 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.
Abbreviations: PIR, the ratio of income to poverty, low-density lipoprotein; WWI, weight-adjusted-waist index; T, trisection.

objects, the mean (SD) WWI is 10.95 (0.86). In individuals with a history of psoriasis, the mean (SD) WWI is 11.14 (0.85).

In comparison to patients without a history of psoriasis, those with such a history were typically older, mostly identified as non-Hispanic white, exhibited higher WWI levels, and experienced a greater chance of diabetes, cardiovascular disease, and hypertension (Table S1). These features in psoriasis individuals categorized by WWI, is elaborately presented in Table 1. Notably, the high WWI group exhibited the highest proportions of female participants, Mexican Americans, individuals with education levels below high school, individuals with a PIR < 1.3, and individuals with no moderate level of exercise, with notable variation found. The high WWI group showed a greater prevalence of cardiovascular disease, diabetes, and hypertension than the low WWI group. Nevertheless, there were no noteworthy variation observed in blood lipid levels, alcohol consumption, smoking habits, or the severity of psoriasis among the WWI groups.

Moreover, Table S2 reveals that, within the psoriatic population, the incidence of deaths attributable to cardiovascular-related causes, cancer causes, and others was notably elevated in the high WWI group when compared to both the low or medium WWI groups.

Association Between WWI and Psoriasis

In Model 1, for each one-unit rise in WWI, there was a rise in the likelihood of developing psoriasis (OR = 1.29, 95% CI 1.17–1.43). In models 2 (OR = 1.20, 95% CI 1.06–1.35) and 3 (OR = 1.15, 95% CI 1.00–1.33), the correlation held significance even after controlling for covariates (Table S3). This strongly implies the importance of heightened WWI for an increased susceptibility to psoriasis. In addition, the results of WWI were divided into trisections, and the association remained significant across all models. Compared with those in the lowest WWI group (T1), those with high WWI (T3) had a 29% higher chance of developing psoriasis (OR = 1.29, 95% CI 0.97–1.72).

Association Between WWI and All-Cause Mortality

The weighted Cox regression analysis demonstrated that the WWI displayed a positive association with overall mortality in individuals affected by psoriasis (Table 2). In model 3, every unit increase in WWI matched a 63% rise in the risk of all-cause mortality (HR = 1.63, 95% CI 1.02–2.61). Participants exhibiting a high WWI demonstrated elevated all-cause mortality in comparison to people with minimal WWI, even so this linear relationship did not reach statistical significance. Kaplan-Meier survival analysis curves showed significant differences in mortality between WWI groups of psoriasis individuals at the end of the follow-up period (log-rank p < 0.001, Figure 2).

In people without psoriasis, the risk of death also increased with the rise of WWI, according to the analysis (Table S4). When the model is fully adjusted, a single unit increment in WWI was found to be associated with a 13% escalation in the risk of mortality in this population (HR = 1.13, 95% CI 1.05–1.23).

Table 2 Multivariate Cox Regression for All-Cause Mortality in Patients with Psoriasis

WWI	Model 1	Model 2	Model 3
	HR (95% CI)	HR (95% CI)	HR (95% CI)
Continuous	2.41 (1.81–3.23)	1.62 (1.12–2.33)	1.63 (1.02–2.61)
Trisection			
T1	1	1	1
T2	1.68 (0.58–4.83)	1.14 (0.39–3.30)	1.02 (0.31–3.36)
T3	7.02 (2.79–17.65)	2.45 (0.91–6.54)	2.06 (0.67–6.37)
P for trend	<0.001	0.019	0.068

Notes: HRs for the Association between WWI and all-cause mortality across in psoriasis individuals. Model 1: no covariates were adjusted. Model 2: age, gender and race were adjusted. Model 3: age, gender, race, education level, marital status, PIR, drinking, smoking, moderate activity, diabetes, hypertension, cardiovascular disease, LDL-C and total cholesterol were adjusted.
Abbreviations: PIR, the ratio of income to poverty; LDL-C, low-density lipoprotein; T, trisection.

Subgroup Analysis of All-Cause Mortality

By dividing the data into distinct groups according to age≥ 60 or < 60, men or women, different health status, subgroup analyses and interaction tests were carried out to investigate whether this connection held true across populations. The results in Table 3 showed that the positive associations between age, sex, tobacco consumption, alcohol consumption, hypertension, diabetes, and heart disease subgroups remained stable (P > 0.05 for interactions).

Impact of the Severity of Psoriasis on Results

Table S5 revealed that the severity of psoriasis did not rise as WWI rose (HR = 1.19, 95% CI 0.78–1.81, p = 0.430). While no significant relationship between psoriasis severity and WWI was found, this may be attributable to the limitations of using a questionnaire to assess severity, as opposed to clinical measurements or other objective markers. More results revealed that patients who endure moderate to severe psoriasis did not exhibit a heightened danger of death compared to people with mild skin lesions (Table S6, HR = 1.59, 95% CI 0.57–4.46, p = 0.378).

Discussion

According to what we know, for the first time the study examines in depth the association between WWI and danger of death from all causes in psoriasis individuals. We mined information from the NHANES database from 2003 to 2006 and 2009 to 2014, covering 19,919 adult individuals with or without psoriasis. This research verified that the psoriasis risk could increase as the WWI increases. In a fully adjusted model, the correlations remained stable The observed association between higher WWI and increased psoriasis risk merits further exploration to understand the underlying mechanisms. Our main findings show that WWI is positively associated with the risk of all-cause death in psoriasis patients. This phenomenon continued to manifest even after rigorous adjustment for demographic variables as well as factors including smoking and alcohol consumption, alongside associated disease. For each additional WWI unit, the risk of death increased by 63%. Although we also observed this positive association in people without psoriasis, the effect was relatively small: for every additional WWI unit, the risk of death increased by only 13%. These results not only illuminate the mortality risk associated with obesity in patients with psoriasis and accentuate the pressing need for obesity screening within this population, but also establish a firm groundwork for further exploration in both basic and clinical studies. In our study, an elevated WWI seemed to have no significant impact on psoriasis severity, potentially due to the influence of the methodological approach, particularly the reliance on self-reported questionnaires for assessing disease severity. In this psoriasis population, the mortality rate did not rise as the disease got worse.

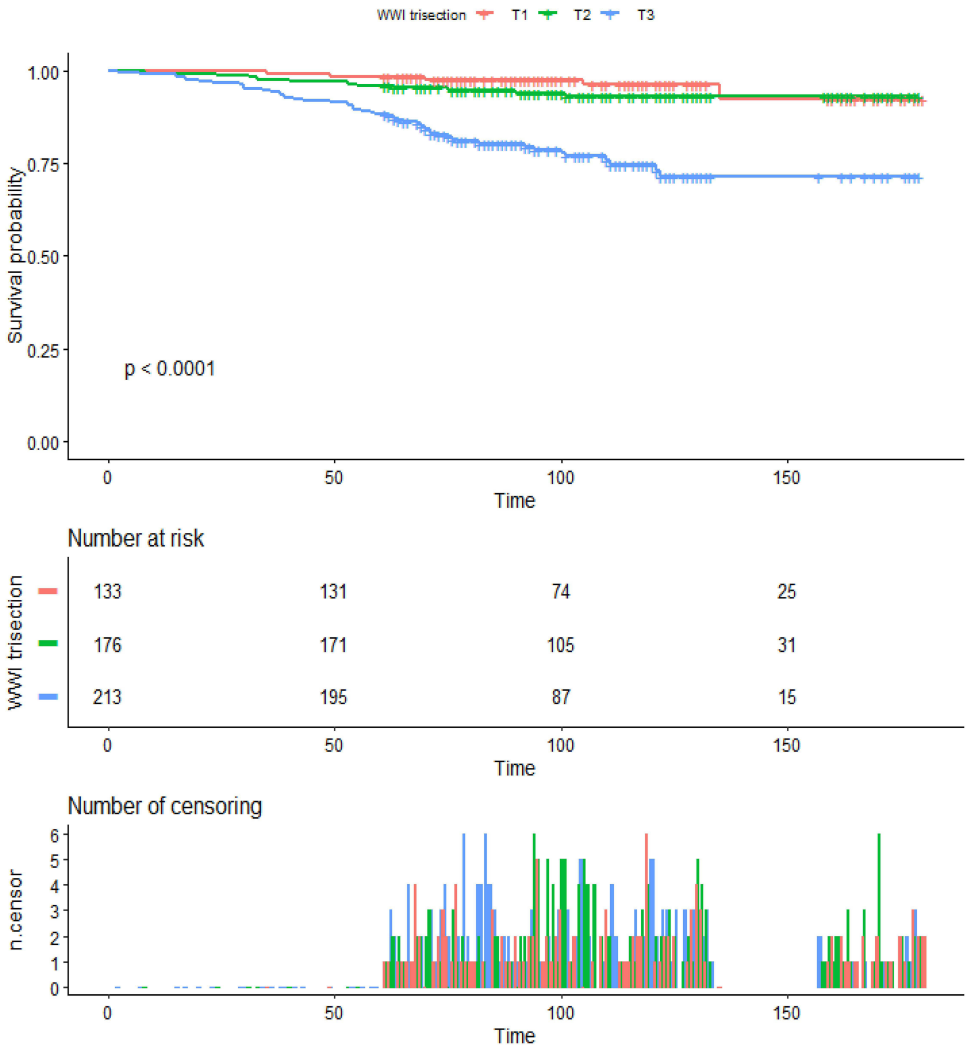

Figure 2 Kaplan–Meier survival analysis of all individuals with psoriasis according to WWI trisection.

Meta-analyses have shown that the comorbidity rates of obesity and psoriasis comorbidities is as high as 25%.[22] A multitude of research have established a compelling correlation between them.[23,24] Research have revealed that the incidence of obesity is greater among individuals with psoriasis in contrast to the general.[11] Moreover, patients with moderate to severe illness are more prone to obesity than those with only a few plaques.[11] Obesity not only contributes to the onset of psoriasis but also augments the probability of developing psoriatic arthritis.[25] Weight management can postpone the advancement of psoriatic arthritis to a certain degree. A prospective study observed improvements in psoriasis symptoms following bariatric surgery.[26] Another study improved the severity of skin lesions in people with psoriasis by reducing body weight through a ketogenic diet.[27] A bioinformatics-based investigation revealed that psoriasis and obesity may interact through a multitude of targets and pathways, identifying ten key targets, including S100A7 and SERPINB4.[28] The binding of the RAGE receptor and the Toll-like receptor engagement had been discovered to concurrently influence both psoriasis and fatness.[28] This insight into overlapping targets and pathways provides a valuable foundation for further exploration into the relationship between psoriasis and obesity from a molecular perspective. Transcriptomic investigations have revealed the genetic association and the foundational role of obesity in psoriasis at the genetic level.[29]

A large number of studies has recognized obesity as a significant lifestyle risk factor closely linked to untimely mortality, emphasizing the imperative of assessing individuals predisposed to obesity in clinical settings. Elevated WWI was consistently a risk factor for higher all-cause mortality in the population, regardless of whether participants had

Table 3 Subgroup Analysis of the Association Between WWI and All-Cause Mortality in Patients with Psoriasis

Subgroup	Adjusted HR (95% CI)	P for Interaction
Age		0.559
≥60	2.02 (1.21–3.40)	
<60	1.55 (0.75–3.22)	
Gender		0.136
Male	2.78 (1.39–5.53)	
Female	1.27 (0.59–2.74)	
Hypertension		0.186
Yes	2.01 (1.13–3.57)	
No	0.81 (0.24–2.68)	
Diabetes		0.255
Yes	2.40 (1.05–5.51)	
No	1.31 (0.71–2.44)	
Cardiovascular disease		0.648
Yes	1.93 (0.96–3.86)	
No	1.56 (0.84–2.91)	
Smoking		0.423
Now	1.22 (0.56–2.66)	
Past	2.17 (1.14–4.14)	
Never	1.31 (0.57–3.03)	
Drinking		0.176
Yes	1.40 (0.80–2.34)	
No	2.93 (1.63–8.14)	

Notes: Age, gender, race, education level, marital status, PIR, drinking, smoking, diabetes, moderate activity, hypertension, cardiovascular disease, LDL-C and total cholesterol were adjusted.

Abbreviations: PIR, the ratio of income to poverty; LDL-C, low-density lipoprotein; T, trisection.

psoriasis.[30–32] The aforementioned correlations remained evident in our study, thus emphasizing the protective impact of lower WWI on the population. There is a paucity of studies exploring the relationship between obesity and mortality in individuals with psoriasis. Research from the identical database indicated that an elevated BMI was notably linked to a heightened risk of all-cause mortality in psoriasis individuals, particularly those with a BMI ≥ 30.[18] Despite employing diverse metrics for obesity, our study indicates a consistent result. Our findings diverge from the research conducted by Noe et al, which showed that patients with more area of lesion affected by psoriasis face a higher risk of death.[33] The variation observed could stem from sample characteristics, study methodology, duration of follow-up, and confounding variables. As such, it is recommended that forthcoming investigations delve deeply into these distinctions.

Our study revealed a strong positive correlation between WWI and psoriasis patients' mortality, in other words, a prominent relationship between obesity and mortality. In this research, we observed a consistent and prominent

correlation between WWI and mortality across various subgroups of patients with psoriasis. This suggests that the correlation is robust and holds true in different demographic or clinical categories within the psoriasis population. Nevertheless, it is imperative to recognize that additional investigation is required to validate these findings across various patient demographics and environments. The influence of WWI on the survival rate of patients with psoriasis may be attributed to several mechanisms: firstly, chronic inflammatory response induced by obesity may aggravate psoriasis symptoms and lead to other complications;[34] secondly, obesity is associated with metabolic syndrome and increases the risk of cardiovascular disease,[35] thus affecting the survival rate; In addition, obesity may affect drug response, quality of life and immune system function, increase the risk of comorbidities, and collectively affect the overall health and survival of patients.

Although our results are encouraging, the study has certain constraints. Firstly, as a cross-sectional study, limits our exploration of causality. Second, the determination of psoriasis relies on questionnaires in place of in-person examinations, which may lead to subjectivity and inevitable recall bias. Third, although we adjusted for some relevant covariates, there are still a few unaccounted elements that could influence the outcomes. For example, elements of lifestyle (like food intake, emotional state, etc), genetics, and other systemic diseases may influence the effect of obesity on the risk of death in psoriasis patients. Finally, the limited availability of data on comorbidities beyond those considered in our analysis represents a limitation, potentially affecting the accuracy of our mortality assessment.

Conclusion

According to our findings, there is a strong correlation between higher WWI and increased all-cause mortality risk in psoriasis patients. While a correlation was also observed in a non-psoriasis cohort, this association was weaker. This suggests that interventions targeting factors contributing to a high WWI may be particularly important for individuals with psoriasis. However, the relationship between WWI and mortality requires further investigation to establish causality and determine the most effective interventions. Future studies should include larger, more diverse populations and explore potential confounding factors to confirm and refine these findings. Further research is needed to validate the WWI as a robust and clinically useful measure of obesity risk in this context, particularly for psoriasis patients.

Data Sharing Statement

The datasets generated and analyzed during the current study are available in the NHANES repository (https://www.cdc.gov/nchs/nhanes/).

Ethical Statement

This study used publicly available anonymized data and was therefore exempt from Institutional Review Board (IRB) review according to Article 32, items 1 and 2, of the Measures for Ethical Review of Life Science and Medical Research Involving Human Subjects (February 18, 2023, China). The study conducted with human participants, materials, or data was approved by the NCHS Ethics Review Board.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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