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ORIGINAL RESEARCH

Association Between a Body Shape Index and Body Roundness Index with Prevalence of Psoriasis: A Cross-Sectional Population-Based Study

Qianjie Wu[1], Ling Yu[2], Qianqian Yu[3]

[1]Department of Nursing, The Affiliated Suqian First People's Hospital of Nanjing Medical University, Suqian, Jiangsu Province, People's Republic of China; [2]Department of Neurology, The First Affiliated Hospital of Nanjing Medical University, Nanjing, Jiangsu Province, People's Republic of China; [3]Department of Pediatrics, The Affiliated Suqian First People's Hospital of Nanjing Medical University, Suqian, Jiangsu Province, People's Republic of China

Correspondence: Ling Yu, Department of Neurology, The First Affiliated Hospital of Nanjing Medical University, No. 300 of Guangzhou Road, Nanjing, Jiangsu Province, 210015, People's Republic of China, Email yuling020203@163.com; Qianqian Yu, Department of Pediatrics, The Affiliated Suqian First People's Hospital of Nanjing Medical University, No. 120 of Suzhi Road, Suqian, Jiangsu Province, 223800, People's Republic of China, Email yqq02012024@163.com

Background: Previous studies have suggested an intimate association between obesity and psoriasis. This study aimed to evaluate and compare the association between traditional and novel obesity biomarkers - waist circumference (WC), body mass index (BMI), a body shape index (ABSI), and body roundness index (BRI) - and the risk of psoriasis.

Methods: This cross-sectional study utilized data from the 2003–2006 and 2011–2014 National Health and Nutrition Examination Survey. The association between obesity biomarkers and psoriasis risk was evaluated using multivariate logistic regression and smoothed curve fitting. The diagnostic performance of various biomarkers for identifying psoriasis were calculated and compared using receiver-operating characteristic curves.

Results: Overall, 12,406 participants without psoriasis, 287 with mild psoriasis, and 68 with moderate-severe psoriasis, were included. Compared to the lowest quartile of WC, BMI, and BRI, higher quartiles were associated with significantly higher risks of psoriasis (all P for trend < 0.05). The area under the curve for identifying psoriasis was highest for BRI, which was comparable to WC (0.581 vs 0.575, P=0.34) but significantly higher than that of ABSI (0.581 vs 0.546, P=0.04) and BMI (0.581 vs 0.569, P=0.007). The association between BRI and psoriasis risk was not influenced by participant's age, sex, smoking status, physical activity, hypertension and diabetes status.

Conclusion: BRI is positively associated with risk of psoriasis and outperforms BMI and ABSI in identifying psoriasis. Given the cross-sectional design of this study, future research employing prospectively designed longitudinal studies is necessary to validate our findings.

Keywords: A body shape index, body mass index, body roundness index, psoriasis, waist circumference

Introduction

Psoriasis is a common and debilitating dermatopathy with an estimated prevalence of approximately 2–3% in Western populations.[1] Although psoriasis is primarily regarded as an immune-mediated inflammatory condition, its exact etiopathogenesis remains largely unknown. An increasing number of observational studies have suggested that psoriasis should not be considered merely as a skin condition characterized by recurrent and extensive patches and plaques, as mechanistic links have been established between psoriasis and an elevated risk of metabolic syndrome and cardiovascular diseases.[2,3] In fact, cardiovascular diseases has been identified to be the leading cause of mortality among patients with psoriasis.

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Obesity is a multifactorial, prevalent endocrine-metabolic disorder that lies at the intersection of insulin resistance, metabolic syndrome and cardiovascular mortality. Emerging evidence showed that obesity and psoriasis are closely intertwined, sharing key features of chronic inflammation.[4] On the one hand, epidemiologic and mechanistic studies have implicated obesity as an independent risk for developing psoriasis and aggravating its clinical course.[5] On the other hand, a pooled analysis of 2.1 million participants revealed that the prevalence of obesity in patients with psoriasis was 66% higher than in those without psoriasis.[6] The complex interplay between obesity and psoriasis involves multiple mechanisms, encompassing dysregulated proinflammatory adipokines (eg, adiponectin, leptin, and resistin), altered cytokine profiles (eg, tumor necrosis factor, and interleukin-6), and a partially shared genetic predisposition.[7]

Traditionally, waist circumference (WC) and body mass index (BMI) have been used as simple anthropometric markers to assess abdominal and general obesity, respectively. Recently, two novel anthropometric indices combining traditional measures of weight, height, and waist circumference, have been proposed as superior alternatives to traditional anthropometric indices. Specifically, the A Body Shape Index (ABSI) and Body Roundness Index (BRI) were introduced in 2012 and 2013 by Krakauer et al and Thomas et al, respectively, to more accurately quantify abdominal adipose tissue and overall body fat percentage.[8,9] Both the ABSI and BRI are independent of BMI and have been associated with an increased risk of a variety of metabolic conditions, such as hypertension, insulin resistance, and non-alcoholic fatty liver disease.[10–12] Furthermore, recent studies reported that ABSI and BRI predict all-cause mortality more effectively than WC and BMI.[13,14] However, it is still unknown whether ABSI and BRI are associated with the risk of psoriasis and their predictive capabilities for identifying psoriasis.

We aimed to examine the relationship between WC, BMI, ABSI, BRI and risk of psoriasis in a population-based study from the National Health and Nutrition Examination Survey (NHANES). Moreover, the predictive capacities of ABSI, BRI and BMI, WC for psoriasis were also calculated and compared to identify the most optimal parameter for potential clinical application.

Methods

Data Source and Study Population

The data used in the current study were derived from the biennial NHANES, which is a continuous, cross-sectional program initiated to collect data on the health and nutritional status of the US population. Information collected by NHANES personnel included demographics, health-related conditions, anthropometric examinations and laboratory tests. The detailed protocol was approved by the NCHS Research Ethics Review Board, and all adult participants provided informed consent.

We included the 2003–2006 and 2011–2014 waves of NHANES in this analysis, since questionnaire on psoriasis was not available in other waves. As shown in the flowchart in Figure 1, among the 21349 participants aged between 20 and 85 years in these waves, we excluded those with pregnancy (n=693), unavailability of psoriasis status (n=3505), missing data of body measures (n=1597), and missing data of covariates (n=2793), leaving 12761 participants for final analysis.

Primary Outcome

Our primary outcome is psoriasis status, determined through the question "Have you ever been told by a doctor or other health care professional that you had psoriasis?". In addition, similar to previous reports,[15] those who responded positively to this question were further dichotomized into mild and moderate-severe psoriasis based on the "little or no psoriasis / only a few patches" and "scattered patches / extensive psoriasis", respectively.

Primary Exposure

The primary exposures of concern are anthropometric measures related to obesity, including WC, BMI, ABSI and BRI. The WC was measured using a tape measure at the upper edge of the iliac crest in centimeters (cm). The BMI was calculated as BMI = body weight (kilograms)/height (meters)/height (meter). According to earlier studies,[16,17] the ABSI and BRI were calculated as WC (m)/[$BMI^{2/3}$ (kg/m^2) × $height^{1/2}$(m)], and $364.2 - 365.5 \times (1 - [WC\ (cm) / 2\pi]^2 / [0.5 \times height\ (m)]^2)^{1/2}$, respectively.

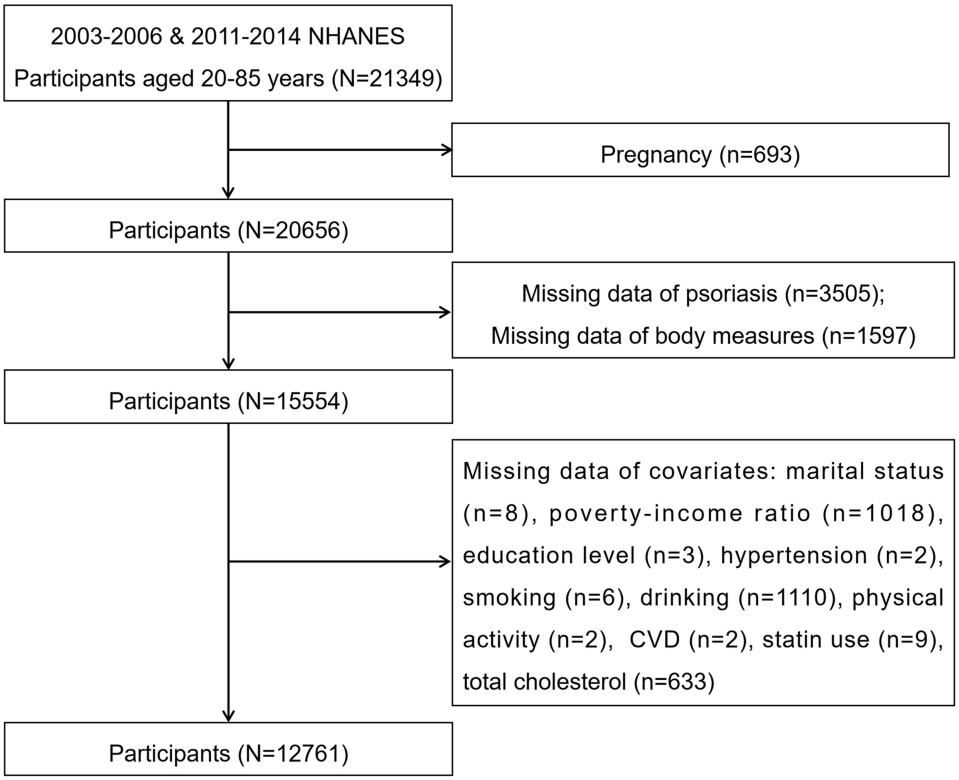

Figure 1 Flowchart of participant selection and exclusion.
Abbreviations: CVD, cardiovascular disease; NHANES, national health and nutrition examination survey.

Assessment of Covariates

Covariates that could potentially affect the relationship between obesity biomarkers and psoriasis risk were incorporated, including demographics, socioeconomic status, lifestyle behaviors, medical comorbidities, and laboratory tests.[18–21] The covariates included age, sex, race/ethnicity, education level, poverty-income ratio, marital status, hypertension, diabetes, smoking, alcohol consumption, physical activity, cardiovascular disease, total cholesterol, triglycerides, high-density lipoprotein cholesterol and statin use. Information on age, sex, race, education and marital status were collected through self-report. Definitions and categorizations for hypertension, diabetes, smoking and drinking were the same with previous studies.[22,23] In brief, participants who reported alcohol consumption < 12 drinks during lifetime or ≥ 12 drinks during lifetime but not in the last year were categorized as never and former, respectively. Participants with alcohol consumption ≥ 12 drinks during lifetime and continued drinking in the last year were further divided into mild (≤ 1 drink/day for women or ≤ 2 drinks/day for men, on average over the past year), moderate (≤ 2 drinks/day for women, ≤ 3 drinks/day for men, or binge drinking on 2 ~ 5 days per month), and heavy (≥ 3 drinks/day for women, ≥ 4 drinks/day for men, or binge drinking ≥ 5 days per month). For physical activity, only those performed for ≥ 10 consecutive minutes during work or leisure time in a typical week were considered. Physical activity intensity was evaluated based on breathing and heart rate changes, and those causing small and large increases in breathing and heart rate were defined as moderate- and vigorous-intensity, respectively.

Statistical Analysis

We compared the baseline characteristics of participants without psoriasis, those with mild psoriasis, and those with moderate-severe psoriasis using survey-weighted one-way analysis of variance or chi-squared tests, as appropriate. Associations between WC, BMI, ABSI or BRI and prevalence of psoriasis were determined by binary logistic regression with obesity biomarkers as continuous variables or ordinal variables. The lowest quartile (Q1) of obesity biomarkers was used as the reference when determining the odds ratio and 95% confidence interval (CI) for the risk of psoriasis in the

Q2, Q3 and Q4 (highest quartile) groups. We constructed 3 logistic regression models: the crude model was unadjusted, whereas the model 1 was adjusted for participant's age, sex, race, marital status, poverty-income ratio, and education level, and the model 2 was further adjusted for diabetes, hypertension, cardiovascular disease, smoking, alcohol consumption, physical activity, triglycerides, total cholesterol, high-density lipoprotein cholesterol and statin use. The restricted cubic spline analysis curves with knots selected based on the Akaike information criterion were plotted adjusting for covariates in model 2 to examine the dose-response relationship between obesity biomarkers and prevalence of psoriasis. To evaluate and compare the discriminative capability of different obesity biomarkers for psoriasis, receiver-operating characteristic (ROC) curves were generated and compared using Delong's test. Subgroup analysis was also performed to examine whether the associations between obesity biomarkers and psoriasis risk differ among different groups. Analyses were performed with the Empowerstats software (version 2.0) and the R package "MASS". A two-sided P value < 0.05 denoted statistical significance.

Results

Comparison of Participant Characteristics

The 12761 participants included 12406 without psoriasis, 287 with mild psoriasis, and 68 with moderate-severe psoriasis (Table 1). Compared with those without psoriasis, participants with moderate-severe psoriasis were more likely to be non-Hispanic white, have a lower poverty-income ratio, with higher prevalence of comorbid hypertension and diabetes,

Table 1 Comparisons of Characteristics of Participants Without Psoriasis, Mild Psoriasis and Moderate-Severe Psoriasis

Characteristics	Total (n=12761)	No Psoriasis (n=12406)	Mild Psoriasis (n=287)	Moderate-Severe Psoriasis (n=68)	P value
N (weighted)	154207213	149,335,407	3,952,840	918,966	
Age, years	44.17 ± 0.33	44.08 ± 0.33	47.85 ± 1.00	43.64 ± 2.10	0.001
Sex (n, %)					0.69
Male	6494 (50.41)	6325 (50.49)	136 (48.37)	33 (46.50)	
Female	6267 (49.59)	6081 (49.51)	151 (51.63)	35 (53.50)	
Race (n, %)					< 0.001
Non-Hispanic White	5777 (69.92)	5561 (69.53)	174 (81.91)	42 (80.96)	
Non-Hispanic Black	2835 (10.55)	2787 (10.71)	38 (5.26)	10 (6.84)	
Mexican American	1839 (8.16)	1814 (8.31)	19 (2.99)	6 (5.76)	
Other Hispanic	935 (4.95)	908 (4.99)	23 (4.16)	4 (1.65)	
Other	1375 (6.42)	1336 (6.45)	33 (5.68)	6 (4.79)	
Marital status (n, %)					0.57
Non-single	7639 (64.34)	7419 (64.26)	177 (67.48)	43 (63.50)	
Single	5122 (35.66)	4987 (35.74)	110 (32.52)	25 (36.50)	
Education (n, %)					0.09
< High school	935 (4.13)	918 (4.19)	16 (2.79)	1 (0.53)	
High school	4575 (32.39)	4465 (32.55)	86 (25.99)	24 (33.47)	
> High school	7251 (63.48)	7023 (63.26)	185 (71.21)	43 (66.00)	

(*Continued*)

Table 1 (Continued).

Characteristics	Total (n=12761)	No Psoriasis (n=12406)	Mild Psoriasis (n=287)	Moderate-Severe Psoriasis (n=68)	P value
Poverty-income ratio	3.05 ± 0.05	3.04 ± 0.05	3.32 ± 0.11	2.74 ± 0.21	0.008
Hypertension (n, %)	4701 (33.86)	4529 (33.47)	140 (45.51)	32 (47.11)	0.001
Diabetes (n, %)	1860 (10.95)	1791 (10.88)	56 (12.48)	13 (14.60)	0.47
CVD (n, %)	1001 (6.54)	958 (6.48)	39 (9.77)	4 (2.03)	0.01
Smoking (n, %)					< 0.001
Never	7016 (53.80)	6847 (54.08)	138 (44.00)	31 (49.96)	
Former	2773 (22.80)	2658 (22.38)	94 (38.04)	21 (25.29)	
Current	2972 (23.40)	2901 (23.54)	55 (17.96)	16 (24.75)	
Drinking (n, %)					0.02
Never	1630 (9.99)	1589 (10.06)	33 (6.71)	8 (12.21)	
Former	2065 (14.01)	1996 (13.94)	53 (15.27)	16 (20.20)	
Mild	4171 (34.91)	4046 (34.84)	107 (39.28)	18 (26.75)	
Moderate	2094 (18.14)	2029 (17.99)	55 (23.98)	10 (16.80)	
Heavy	2801 (22.96)	2746 (23.17)	39 (14.76)	16 (24.04)	
Physical activity (n, %)					0.86
None	6485 (45.69)	6303 (45.63)	149 (48.14)	33 (44.31)	
Moderate	2979 (25.53)	2896 (25.56)	64 (23.51)	19 (29.84)	
Vigorous	3297 (28.78)	3207 (28.81)	74 (28.35)	16 (25.85)	
Triglyceride, mmol/L	1.70 ± 0.02	1.70 ± 0.02	1.67 ± 0.09	2.20 ± 0.36	0.37
TC, mmol/L	5.06 ± 0.02	5.06 ± 0.02	5.17 ± 0.08	5.04 ± 0.16	0.44
HDL, mmol/L	1.37 ± 0.01	1.37 ± 0.01	1.36 ± 0.03	1.26 ± 0.05	0.09
Statin use (n, %)	1865 (13.62)	1797 (13.59)	58 (15.30)	10 (10.61)	0.68
Height, cm	169.52 ± 0.14	169.53 ± 0.14	169.23 ± 0.62	169.33 ± 1.42	0.89
Weight, kg	82.70 ± 0.32	82.56 ± 0.32	86.57 ± 1.69	88.66 ± 3.88	0.01
BMI, kg/m^2	28.70 ± 0.12	28.65 ± 0.12	30.17 ± 0.53	30.94 ± 1.39	0.002
WC, cm	98.26 ± 0.28	98.12 ± 0.28	102.07 ± 1.08	104.44 ± 3.25	< 0.001
ABSI	0.081 ± 0.000	0.081 ± 0.000	0.082 ± 0.000	0.082 ± 0.001	0.03
BRI	5.18 ± 0.04	5.16 ± 0.04	5.70 ± 0.15	6.16 ± 0.53	< 0.001

Notes: n and N represent the number of participants before and after weighting, respectively. P denotes the comparisons among the 3 groups.
Abbreviations: ABSI, a body shape index; BMI, body mass index; BRI, body roundness index; CVD, cardiovascular disease; TC, total cholesterol; WC, waist circumference.

and were less likely to be never smokers. No significant differences with regard to triglycerides, total cholesterol, high-density lipoprotein and statin use were observed among the 3 groups. Notably, WC, BMI, ABSI and BRI showed significant differences among the 3 groups, with the highest values observed in participants with moderate-severe psoriasis.

Associations of WC, BMI, ABSI, BRI and Risk of Psoriasis

As illustrated in Table 2, increasing WC, BMI, ABSI and BRI were all associated with increased prevalence of psoriasis in the crude model. This relationship is still present when adjusted for all covariates in the model 2, except for ABSI. Similarly, compared to the lowest quartile (Q1) of WC, BMI, and BRI, increasing quartile was associated with a significantly higher risk of psoriasis (all P for trend < 0.05). Restricted cubic spline analysis (Figure 2) indicated that an increasing WC, BMI, and BRI were all linearly associated with higher risk of psoriasis (all P for overall < 0.05, P for nonlinearity ≥ 0.05), whereas ABSI was not associated with psoriasis risk (P for overall = 0.36).

Comparison of the Diagnostic Yield

We then compared the diagnostic yield of WC, BMI, ABSI and BRI for identifying psoriasis using ROC curve analysis. The results (Figure 3 and Table 3) showed that the area under the curve was highest for BRI, which was comparable to WC (0.581 vs 0.575, P=0.34) but significantly higher than that of ABSI (0.581 vs 0.546, P=0.04) and BMI (0.581 vs 0.569, P=0.007).

Table 2 Associations Between WC, BMI, ABSI, BRI and Risk of Psoriasis in Participants from the National Health and Nutrition Examination Survey

	Crude model		Model 1		Model 2	
	OR (95% CI)	**P value**	**OR (95% CI)**	**P value**	**OR (95% CI)**	**P value**
WC (continuous)	1.02 (1.01–1.02)	<0.001	1.02 (1.01–1.02)	<0.001	1.01 (1.01–1.02)	0.002
WC quartiles						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	1.26 (0.83–1.91)	0.29	1.29 (0.85–1.95)	0.23	1.24 (0.81–1.91)	0.33
Q3	1.59 (1.18–2.15)	0.004	1.62 (1.18–2.22)	0.005	1.48 (1.07–2.05)	0.02
Q4	2.01 (1.40–2.87)	<0.001	2.06 (1.44–2.96)	<0.001	1.76 (1.17–2.66)	0.01
P for trend	<0.001		<0.001		0.006	
BMI (continuous)	1.03 (1.02–1.05)	<0.001	1.04 (1.02–1.05)	<0.001	1.03 (1.01–1.05)	0.009
BMI quartiles						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	1.62 (1.12–2.35)	0.01	1.62 (1.11–2.35)	0.01	1.54 (1.06–2.24)	0.03
Q3	1.67 (1.14–2.45)	0.01	1.72 (1.15–2.57)	0.01	1.57 (1.05–2.36)	0.04
Q4	1.92 (1.35–2.72)	<0.001	2.01 (1.40–2.88)	<0.001	1.69 (1.14–2.51)	0.01
P for trend	0.002		< 0.001		0.03	
ABSI (continuous)	1.37 (1.08–1.74)	0.02	1.18 (0.90–1.54)	0.23	1.12 (0.84–1.49)	0.44
ABSI quartiles						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	0.98 (0.67–1.41)	0.89	0.92 (0.64–1.33)	0.66	0.90 (0.62–1.30)	0.58
Q3	1.53 (1.08–2.17)	0.02	1.39 (0.97–2.00)	0.08	1.34 (0.92–1.94)	0.14
Q4	1.30 (0.92–1.85)	0.15	1.06 (0.72–1.57)	0.77	0.98 (0.64–1.48)	0.91
P for trend	0.04		0.35		0.61	
BRI (continuous)	1.11 (1.07–1.16)	<0.001	1.12 (1.07–1.17)	<0.001	1.10 (1.04–1.16)	0.002
BRI quartiles						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	1.42 (0.88–2.30)	0.16	1.39 (0.85–2.30)	0.20	1.33 (0.81–2.20)	0.27
Q3	1.70 (1.24–2.33)	0.002	1.70 (1.22–2.37)	0.003	1.59 (1.12–2.24)	0.01
Q4	2.18 (1.53–3.11)	<0.001	2.22 (1.49–3.30)	<0.001	1.93 (1.24–3.00)	0.006
P for trend	<0.001		<0.001		0.003	

Abbreviations: ABSI, a body shape index; BMI, body mass index; BRI, body roundness index; WC, waist circumference.

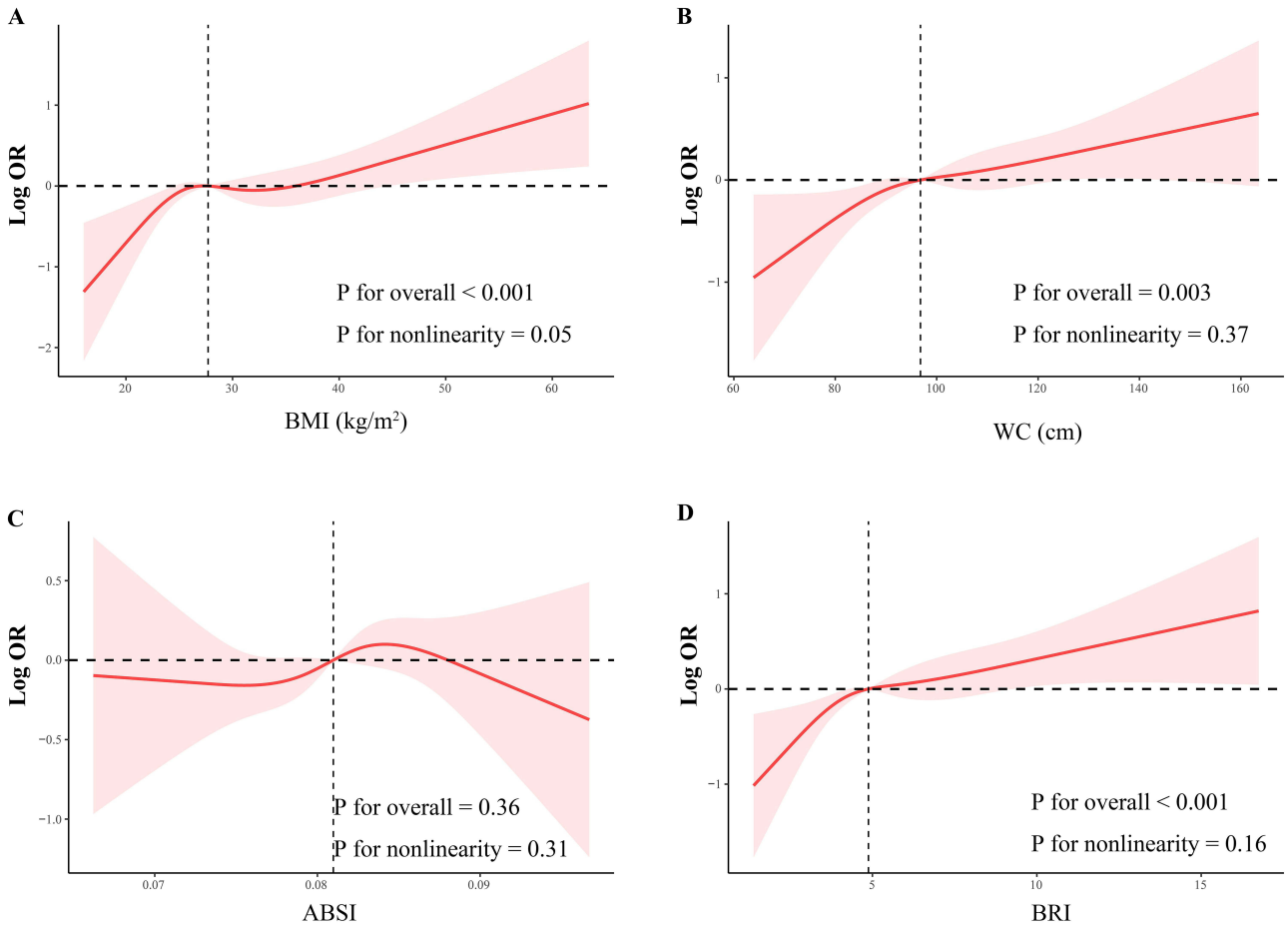

Figure 2 Restricted cubic spline analysis for the associations between body mass index (**A**), waist circumference (**B**), a body shape index (**C**), body roundness index (**D**) and risk of psoriasis.

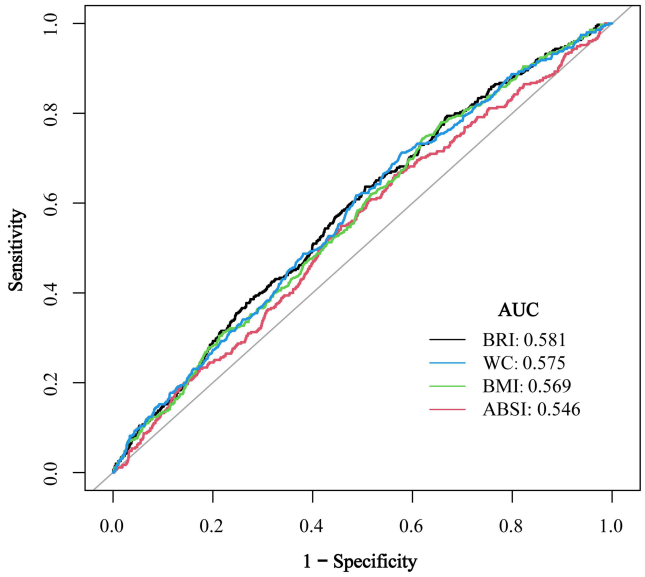

Figure 3 Receiver-operating characteristic curves of various obesity indexes for the identification of participants with psoriasis.
Abbreviations: ABSI, a body shape index; BMI, body mass index; BRI, body roundness index; WC, waist circumference.

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Table 3 Results of Various Biomarkers for the Discrimination of Participants with Psoriasis from Those Without Psoriasis Using Receiver-Operating Characteristic Curve

Parameters	Cut-off	AUC (95% CI)	Specificity (%)	Sensitivity (%)	P
BRI	4.83	0.581 (0.552–0.610)	49.48	63.66	Ref.
ABSI	0.08	0.546 (0.516–0.576)	43.60	66.20	0.04
BMI	26.00 kg/m^2	0.569 (0.540–0.599)	37.98	74.37	0.007
WC	93.55 cm	0.575 (0.546–0.605)	42.12	71.27	0.34

Abbreviations: ABSI, a body shape index; AUC, area under the curve; BMI, body mass index; BRI, body roundness index; CI, confidence interval; WC, waist circumference.

Stratified Analysis

Given that the BRI had the largest area under the curve for identifying psoriasis, we then analyzed the association between BRI and psoriasis risk using subgroup analysis. The results (Figure 4) indicated that the association between BRI and psoriasis risk was not affected by participant's age, sex, smoking status, physical activity, hypertension and diabetes status.

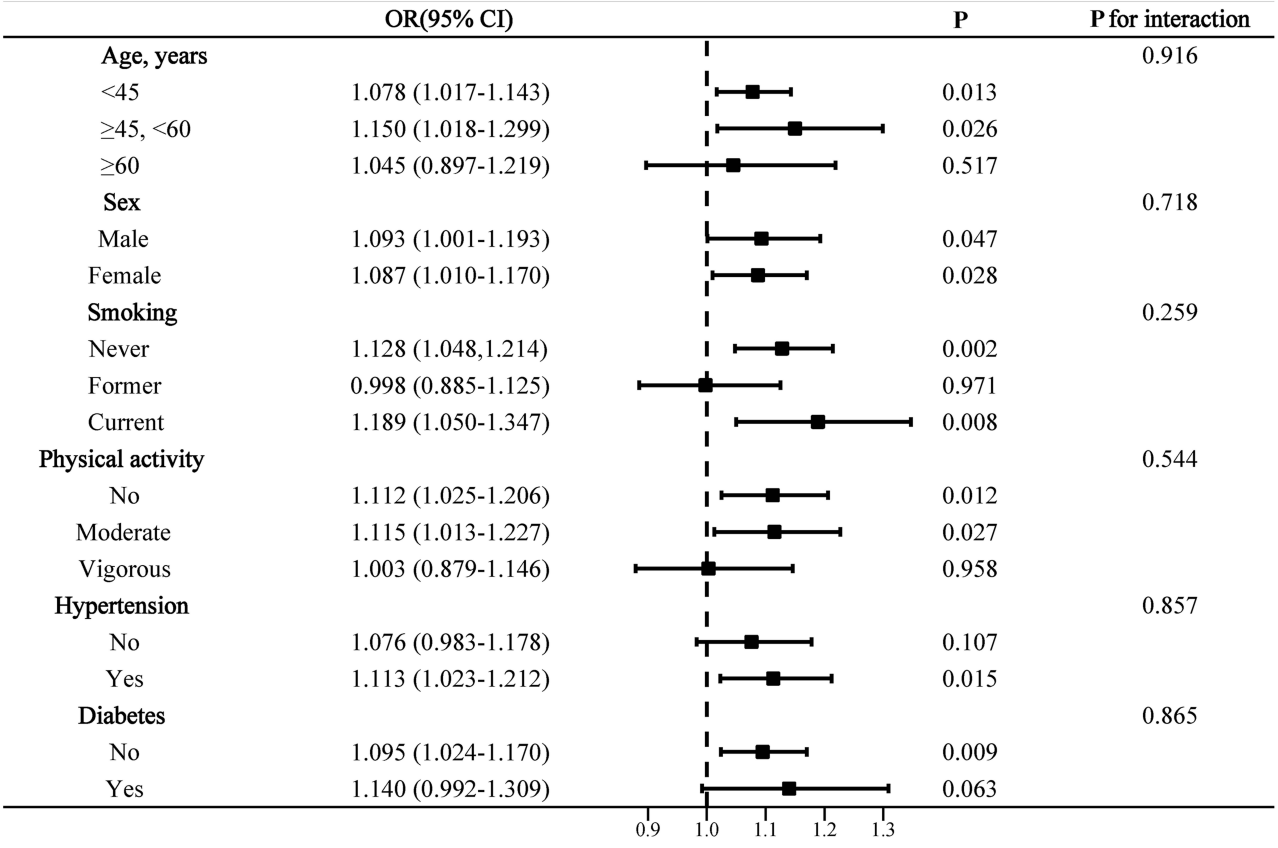

Figure 4 Forest plots of the subgroup analysis.

Discussion

Using nationally representative data, our study examined the relationships between traditional and novel obesity biomarkers and risk of psoriasis. The results indicated that WC, BMI, BRI, but not ABSI, were correlated significantly with risk of psoriasis. This association was robust and consistent across subgroups, unaffected by participant's age, sex, smoking status, physical activity, hypertension and diabetes status. Moreover, BRI and WC demonstrated comparable diagnostic performance in identifying psoriasis. Our study highlights that simple anthropometric measurements, such as WC and BRI, may be useful for the early detection of psoriasis.

The interplay between obesity and psoriasis has long been observed, with some even suggesting a causal relationship between the two conditions.[24] Both cross-sectional studies and prospective studies have indicated that increased adiposity, such as a higher BMI or WC, is strongly associated with an elevated risk of psoriasis. For instance, a meta-analysis showed that a 5kg increase in body weight and a 10 cm increase in WC were associated with an 11% and 24% increased risk of psoriasis, respectively.[25] Other lines of evidence, such as that the presence of obesity predicts treatment failure or discontinuation of biologic agents for psoriasis,[26] and that weight loss through dietary management, exercise, or bariatric surgery with improved metabolic profiles improves psoriasis severity and response to psoriasis treatment,[27] further underscores the critical importance of obesity in the identification and management of patients with psoriasis. Similar to these findings, our study also observed a generally higher risk of psoriasis in participants with higher WC, BMI, or BRI.

WC and BMI are simple anthropometric indexes extensively used in observational and epidemiologic studies for the characterization of obesity. We are aware that prior studies have reported inconsistent results regarding the association between BMI, WC and risk of psoriasis. For instance, the HUNT study of 33,734 individuals found that a one standard deviation increase in BMI and WC were associated with a 1.22- and 1.26-fold increased risk of developing psoriasis, respectively.[28] However, Kumar et al demonstrated that the association between WC and psoriasis risk disappeared after adjusting for BMI in female patients, suggesting BMI may outweigh WC in predicting psoriasis in this population.[29] In the present study with heterogeneous ethnicity and both sexes, we found that the predictive capabilities of WC was slightly higher than that of the BMI, a discrepancy we believe that might be related to differences in patient characteristics.

It is increasingly recognized that both BMI and WC have limitations in assessing obesity and adiposity. Specifically, BMI does not distinguish between fat from lean mass, and fails to depict fat distribution in the meantime.[30] The WC, a surrogate marker of central obesity, does not take into account the subject's height and weight. In light of these limitations, Krakauer et al proposed the ABSI, which incorporates WC, weight and height, and demonstrated that it can predict mortality in the general population independently of BMI.[8] The BRI is a novel geometrical index developed by Thomas' group that estimates visceral fat and total body fat percentages.[9] Earlier studies have indicated that BRI and/or ABSI outperformed BMI and WC for predicting metabolic syndrome and carotid atherosclerosis,[31,32] which is largely consistent with our findings. However, other studies have reported that BRI or ABSI is not superior to BMI or WC for identifying diabetes or assessing cardiovascular health.[33,34] These apparent inconsistencies suggest that the predictive capabilities of ABSI and BRI may depend on the underlying condition and the specific characteristics of the population being studied.

Given the limitations of WC and BMI, and encouraged by the finding that weight-adjusted waist index outperformed BMI and WC in correlating with psoriasis risk,[35] we undertook this study to further substantiate the utility of ABSI and BRI in psoriasis. Our findings that WC, BMI and BRI are all linearly associated with psoriasis risk are not surprising, given the well-established association between obesity and psoriasis. However, ABSI was not associated with psoriasis risk, which we believe may be related to the fact that it was originally developed to predict mortality risk in a follow-up study and is therefore not appropriate for the cross-sectional design of this study. In addition, BRI appears to be superior to BMI in predicting psoriasis, providing further insight into the relationship between obesity and psoriasis.

This study may have several practical clinical implications for physicians and nurse practitioners. First, our study showed that simple anthropometric measures of WC and BRI may help clinicians and nurse practitioners in the early

detection of patients at an elevated risk for psoriasis. Second, the current work adds to the growing body of evidence highlighting the hazards of obesity, such as increased risk of psoriasis, which should be emphasized during patient education. Finally, clinicians and nurses should counsel obese patients on the benefits of weight control, such as through dietary or lifestyle interventions, to reduce the risk of psoriasis.

Although the present study is nationally representative that allows for generalization and external extrapolation, the following limitations should be considered and acknowledged. First, this work could not establish a causal relationship between obesity and psoriasis due to its cross-sectional design. Prospective, longitudinal studies are needed to unveil the causal relationship between obesity and psoriasis. Second, data on psoriasis status were collected through self-report, which may be subject to recall bias. A previous study in Norway showed that the sensitivity, specificity, positive predictive value and negative predictive value for psoriasis by self-report in the general population were 56%, 99%, 78% and 96%, respectively.[36] In addition, the number of participants with moderate to severe psoriasis was relatively small. Third, all obesity biomarkers in this study were derived from single baseline measurements, thus precluding the evaluation of the time-varying association between changes in obesity biomarkers and psoriasis development. For example, the menopausal transition, a critical period marked by significant hormonal changes, has been demonstrated to contribute to alterations in body composition and increased adiposity.[37] At last, even though we have included many potentially confounding factors as covariates, we cannot completely exclude the possibility of residual confounding from unmeasured or poorly measured factors, such as dietary habits, duration of obesity, psoriasis treatment, and genetic background.

Conclusion

In conclusion, this nationally representative, cross-sectional study showed that the novel anthropometric index BRI is positively associated with risk of psoriasis and outperforms traditional measures such as WC and BMI in identifying psoriasis. These findings provide evidence for proposing BRI as a noninvasive screening tool for psoriasis in clinical practice in the future.

Data Sharing Statement

This study used publicly available database that can be freely accessed at: https://wwwn.cdc.gov/nchs/nhanes/Default.aspx.

Ethics Statements

According to Article 32 of the Ethical Review Measures for Life Science and Medical Research Involving Human Beings of the People's Republic of China, the data used in this study will not cause any form of harm to human beings, nor will it touch sensitive personal privacy or trade secrets, so the ethical review can be exempted. In addition, the database used in this study was publicly available and legally available.

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Disclosure

The authors report no conflicts of interest in this work.

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