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Body mass index and severity of psoriasis: a cross-sectional study

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Background: The relationship between body mass index (BMI) and the severity of psoriasis is of debate. We investigated the relationship between BMI and psoriasis area and severity index (PASI) in Northern Iran.

Method: In this prospective, observational descriptive study, 190 patients with chronic plaque-type psoriasis were included from January 2015 to 2017. None of the patients used systemic therapy for psoriasis during the last month.

Results: There was a slight female predominance in our study (n = 116; 61.1%). The mean age of our patients was 28.88 ± 18.17 (mean ± standard deviation) years. We found a positive correlation between BMI and PASI in the groups of psoriatic patients who had normal weight or were overweight (r = 0.369, *P* = 0.006 and r = 0.287, *P* = 0.019, respectively). In the final logistic regression model, it was shown that in cases with BMI < 18.5, the mean PASI score was lower in comparison with those with normal BMI (OR = 0.074, CI: 0.009, 0.636).

Conclusion: A relationship between BMI and PASI was only seen in psoriatic patients who had normal weight or were overweight. To reduce the effect of factors such as systemic treatments, it is suggested to evaluate the relationship between BMI and PASI score as soon as the diagnosis of psoriasis is confirmed.

Keywords: body mass index, obesity, overweight, psoriasis

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INTRODUCTION

Psoriasis is a common immune-mediated skin disorder that affects about 2-3% of the general population. The age of onset of psoriasis is before 40 years in up to 75% of patients and it seems to be lower in women in comparison with men [1].

The etiology of psoriasis is unknown, but the disease has an autoimmune basis and strong genetic components. Human leukocyte antigens (HLA) alleles are involved in the pathogenesis of the disease; for example, HLA CW6 is an important susceptibility gene [2].

Psoriasis is a chronic inflammatory disease mediated by Th1 and Th17, resulting in the production of mediators such as interferon-γ, tumor necrosis factor-α (TNF-α), interleukin (IL)-6 and IL-22. These mediators are associated with metabolic syndrome due to similar inflammatory pathways and genetic predispositions. Studies have shown that metabolic syndrome is associated with moderate to severe psoriasis; however, a clear link between cardiovascular disease and psoriasis is of debate [3,4]. Obesity is a pro-inflammatory condition in which fatty tissues act as an endocrine organ as well as an immune organ. The inflammatory factors produced by adipose tissues can also contribute to the development of psoriatic skin lesions.

Obese individuals who have a high density of fat in their bodies possess high levels of TNF-α [5]. Other factors secreted by adipose tissues consist of adipokines, cytokines (e.g., TNF-α and IL-6), and chemokines with different paracrine and eccrine effects [6]. All of these proinflammatory factors can be implicated in the stimulation of T cells involved in psoriatic cutaneous lesions. Leptin is another hormone that increases in level in obese subjects; this hormone also affects the proliferation of T cells and stimulates the production of TNF-α in adipose tissues. This inflammatory process can also play a role in psoriasis lesions [7].

Resistin is also produced by stromal macrophages in the abdominal fat tissues (omentum) and can cause insulin resistance. Studies reported a correlation between resistin serum levels and the severity of psoriasis [5].

The association between psoriasis and obesity has been tightly established in epidemiological studies [8-14]. Some controversies exist about the relationship between the severity of psoriasis and body mass index (BMI) levels. In addition, some studies found that weight loss in obese patients is associated with an increased response to treatment [9], while others found no relationship [14-16].

It seems that not only there are associations between excess weight and psoriasis but also obesity itself can be an independent risk factor in the development of psoriasis [17-19]. On the contrary, these associations are compounded by weight gain as an adverse effect of anti-TNF-α therapy among patients [20].

The present study aimed to assess the relationship between body weight and severity of psoriasis in patients who had not used any systemic drugs in the preceding month.

MATERIALS AND METHODS:

In this cross-sectional study, consecutive patients with plaque-type psoriasis who were referred to our dermatology department were evaluated between January 2015 and January 2017. The inclusion criteria consisted of patients with plaque-type psoriasis who had not used any systemic treatments (including anti-TNF-α) for psoriasis in the preceding month.

Patients receiving topical treatment (except emollient) in the previous month and patients with other clinical phenotypes of psoriasis were excluded. The BMI (weight in kilograms divided by the square of the height in meters) was calculated for all subjects.

The patients were classified into four groups: underweight (BMI less than 18.5), normal weight (BMI ranging from 18.5 to 24.9), overweight (BMI ranging from 25 to 29.9), and obese (BMI more than 30). The severity of psoriasis was measured based on the psoriasis area severity index (PASI). The four categories of PASI were mild (0-3.9), moderate (4-7.9), severe (8-15.9), and very severe (more than 16) [14]. The areas of psoriasis involvement were divided into the scalp, upper limb, lower limb, trunk, and palmoplantar area.

Written informed consent was obtained from the subjects and the study protocol was approved by the ethical and scientific committee of Guilan University of Medical Sciences (GUMS)

Statistical analysis

Statistical analysis was performed using SPSS 19.0 software; the Spearman correlation coefficient was used to test the relationship between PASI and BMI. The chi-squared test and Fisher's exact test were used to compare the distribution of PASI in different groups of BMI. The logistic regression model was used to adjust for the age and gender as well as the location of psoriasis involvement. The significance level of the tests was considered as $P < 0.05$.

RESULTS

In this study, the mean age of patients was 41.43 ± 16.73 years (range: 18 to 84 years) with the majority of patients being female (61.1%) (Table 1).

The mean PASI score was 6.34 ± 4.65, with a minimum value of 0.3 and a maximum value of 27.4. Spearman's correlation coefficient was calculated as r = 0.072 for the correlation between BMI and severity of psoriasis (based on PASI score) in our study, but this was not statistically significant ($P = 0.329$).

However, in the split analysis, the relationship between BMI and PASI score was statistically significant in normal-weight individuals (r = 0.369, $P = 0.006$). This correlation was also significant in overweight cases (r = 0.287, $P = 0.019$). The relationship between PASI and BMI indicated a

Table 1. The demographics and clinical findings of the study population

Characteristics	Results
Gender, N (%)	
Male	74 (38.9)
Female	116 (61.1)
Age (mean ± SD)	41.43 ± 16.73
Age groups, N (%)	
<30 years	63 (33.2)
Between 30 to 50 years	68 (35.8)
≥ 50 years	59 (31.1)
Age at the onset of psoriasis (mean ± SD)	28.88 ± 18.17
The groups of age at the onset of psoriasis, N (%)	
< 30 years	110 (57.9)
Between 30 to 50 years	40 (21.1)
≥ 50 years	40 (21.1)
BMI (mean ± SD)	27.30 ± 5.53
BMI categories, N (%)	
BMI < 18.5	16 (8.4)
18.5 ≤ BMI < 24.9	55 (28.9)
25 ≤ BMI < 29.9	67 (35.3)
BMI ≥ 30	52 (27.4)
Areas of involvement, N (%)	
Head and neck	122 (64.2)
Trunk	99 (25.1)
Upper limb	129 (67.9)
Lower limb	146 (76.8)
Palmoplantar	34 (17.9)
PASI score (mean ± SD)	6.36 ± 4.65

Abbreviations: BMI, body mass index; N, number; PASI, psoriasis area and severity index; SD, standard deviation.

low-level relationship in both groups. Of note, the relationship between PASI and BMI was not significant among obese subjects. In the underweight subjects, the relationship between BMI and PASI showed a reverse link (r = -0.283) that was not statistically significant (P = 0.289). Figure 1 shows the correlation between BMI and PASI according to the BMI status.

In the comparison of the four BMI groups, we found a significant difference between the groups in terms of the median PASI score (P = 0.002; Figure 2). In the two-way comparison of PASI score in terms of the BMI with the use of the Mann-Whitney U test, the results showed that the difference was significant between the two groups of underweight and normal-weight individuals (P < 0.0001), between the underweight and overweight individuals (P = 0.002), and between the underweight and obese cases (P = 0.018). It seemed that the underweight group had a significant difference with all other BMI categories. However, there was no correlation between normal-weight and overweight individuals (P = 0.264), between normal weight and obese subjects (P = 0.054), and between overweight and obese subjects (P = 0.037) (Table 2).

In multiple analyses, the logistic regression model was used to modify the effects of age, age

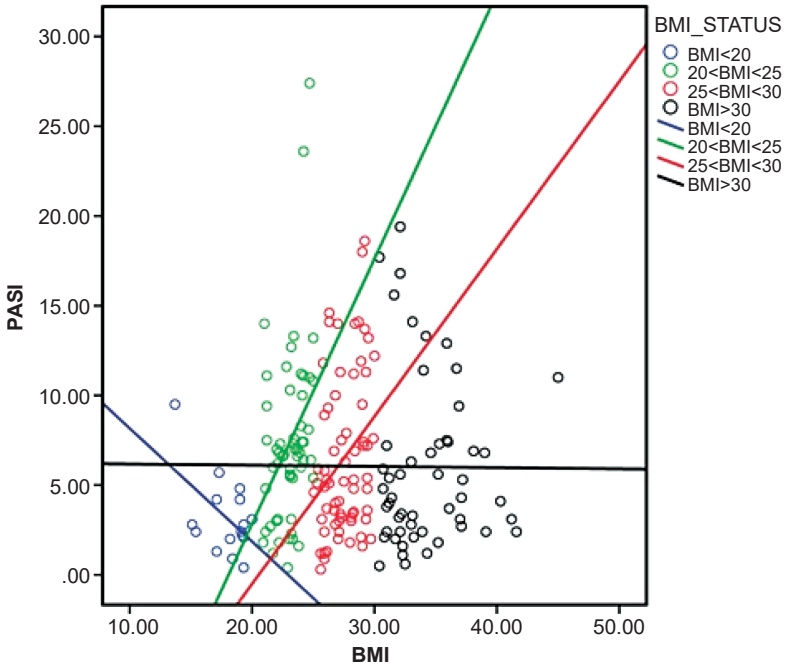

Figure 1. Scatter plot of correlation between BMI and PASI score in terms of BMI status.

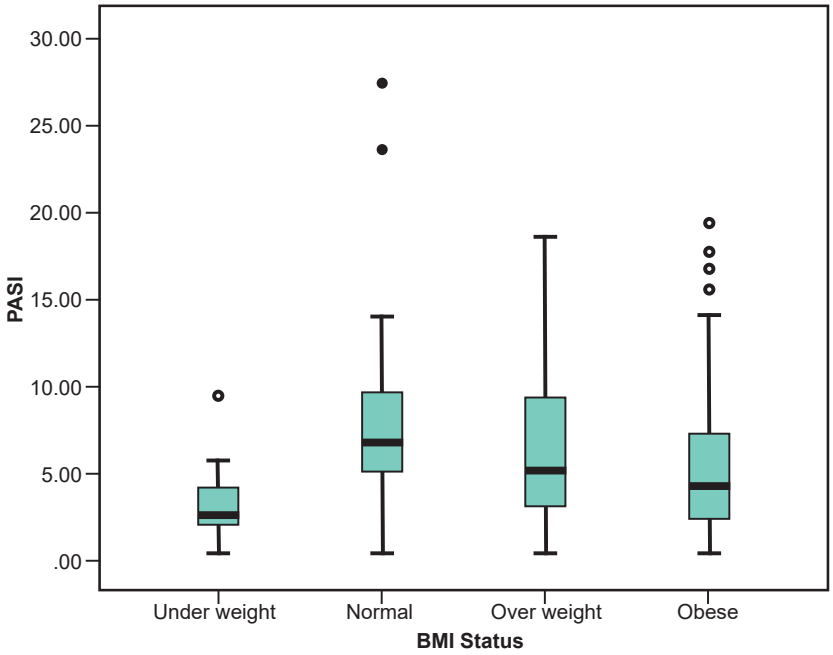

Figure 2. Bar plot of the median PASI score in terms of BMI status.

Table 2. Comparison of mean, standard deviation and other statistical parameters of PASI according to BMI status

	BMI status				*P*	*P*	*P*	*P*	*P*	*P*	*P*
	BMI<18.5 (1)	18.5≤BMI< 24.9 (2)	25 ≤ BMI < 29.9 (3)	BMI≥ 30 (4)	1,2,3,4	1,2	1,3	1,4	2,3	2,4	3,4
PASI											
Number	16	55	67	52	0.002*	0.0001*	0.002*	0.018*	0.264	0.054	0.37
Mean	3.18	7.40	6.55	6.01							
SD	2.20	4.93	4.49	4.72							
Median	2.60	6.80	5.20	4.30							
Percentile 25	2.05	4.80	3.10	2.40							
Percentile 75	4.20	10.00	9.50	7.35							

*Statistically significant

at the onset of disease, and gender to investigate the relationship between PASI and BMI. In this model, the response variable was defined as *zero* for the PASI scores that were less than the mean PASI score (mean PASI score was considered as 6.4) and as *one* for the PASI scores that were above the mean PASI score. This model was implemented with the probability of entering a variable equal to 0.05 and an output equal to 0.1 by backward logistic regression.

Table 3 shows that in the final logistic regression model, differences between a BMI less than 18.5 and normal weight ($P = 0.018$), overweight and normal weight ($P = 0.019$), and obese and normal weight ($P = 0.008$) were statistically significant. This was such that those with a BMI less than 18.5 had a lower mean PASI score than those with normal weight (OR = 0.74). Also, overweight and obese patients had a lower chance for PASI scores above the mean PASI score in comparison with the normal ones, and their relative odds (OR) were 0.49 and 0.387, respectively.

In this study, we found borderline statistical significance between PASI and BMI in the female group (r = 0.181, $P = 0.05$). In the study of the correlation between the PASI score and BMI according to the three age groups, Spearman's correlation coefficient showed that there was a positive relationship in the age group of fewer than thirty years as well as the age group of between thirty and fifty years; also, we found a negative relationship in the age group of older

Table 3. Regression coefficients of the relative odds of PASI predictors according to the logistic regression model

	B regression coefficient	S.E.	Significance	Odds Ratio	95% CI. for Odds Ratio	
					Lower	Upper
First Models						
Age	.033	.018	.059	1.034	.999	1.071
Age at onset	-.013	.015	.408	.988	.959	1.017
Gender	.061	.339	.857	1.063	.547	2.064
BMI status[#]			.011			
BMI < 18.5 vs. normal	-2.529	1.104	.022	.080	.009	.694
BMI 25-29.9 vs. normal	-.907	.391	.020	.404	.188	.868
BMI > 30 vs. normal	-1.083	.420	.010	.338	.148	.772
Constant	-.718	.769	.350	.488		
Final models						
Age	.021	.010	.042*	1.021	1.001	1.042
BMI status			.007*			
BMI <18.5 vs. normal	-2.602	1.097	.018*	.074	.009	.636
BMI 25-29.9 vs. normal	-.894	.381	.019*	.409	.194	.863
BMI > 30 vs. normal	-1.089	.408	.008*	.337	.151	.749
Constant	-.470	.506	.353	.625		

[#]Variable(s) entered at step 1: age, age at onset, gender, and BMI status
*Statistically significant
Abbreviations: BMI, body mass index; SE, standard error.

than fifty years. However, these findings were not statistically significant (r = 0.153, 0.149, and -0.231 and P = 0.110, 0.357, and 0.151, respectively).

In the study of the correlation between the PASI score and BMI according to the different areas of the body involved, we only found a significant correlation in the head and neck area (r = 0.18, P = 0.047) (Figure 3).

DISCUSSION

Studies in recent years have investigated the relations between psoriasis and other autoimmune diseases, including metabolic syndrome. Among these entities, obesity strikes as the most important component of this association. The key feature of this connection is chronic inflammation. However,

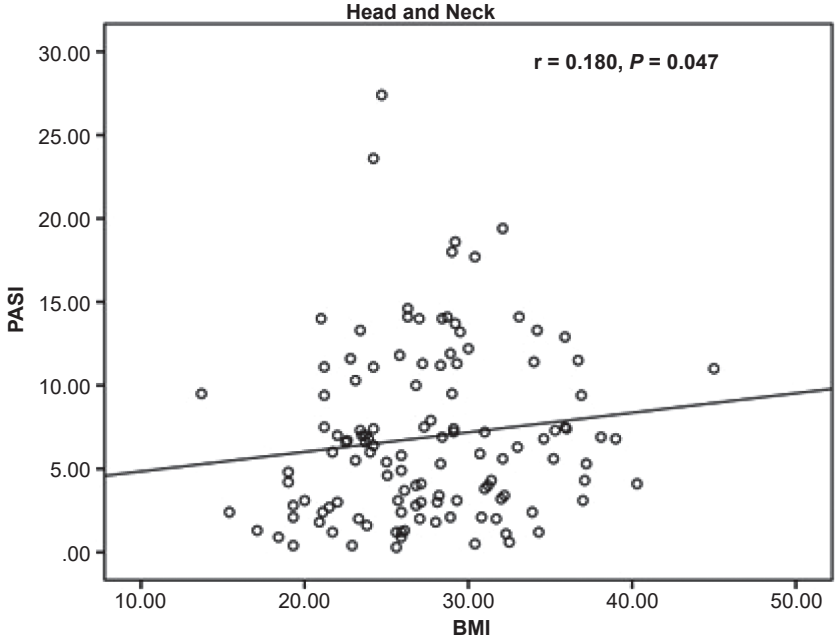

Figure 3. Scatter plot of the correlation between the BMI and the PASI score in the head and neck area.

some controversy exists because of various definitions and classifications [20-22]. Naldi *et al*, for the first time, reported the relationship between psoriasis and obesity in a study including 159, 200 individuals who were followed up over a 10-year period. In that study, the authors found an association between psoriasis and obesity among women [9].

In studying the correlations between BMI and the severity of psoriasis, a higher median for PASI was obtained in the normal-weight patients relative to their overweight counterparts. In the mentioned groups, an increase in weight was associated with increased severity of psoriasis, while such a correlation was not found among obese objects. These findings are consistent with those of Tripo *et al.*, who found a statistically significant relationship between PASI and BMI in overweight patients compared with normal-weight subjects [19]. However, in our study, the underweight patients were separated from the normal-weight patients. Also, comparing the four classic BMI groups showed that the mean PASI score was highest in normal-weight patients.

Murray *et al.* found a correlation of BMI with Physician's Global Assessment (PGA) scores and psoriasis severity. Confounding factors such as cigarette smoking and disease duration were not considered in that study [9] Huang *et al.* reported that the effect of obesity on the severity of psoriasis was greater in men than in women [18]. This may be because the production of TNF-α and IL-6 is greater in visceral adiposity than in subcutaneous adipose tissue.

Of note, our findings were different from the results of previous studies in which the severity of the disease increased in parallel with the rise in BMI [8,14]. One of the reasons for this difference could be that in our study, we considered only the BMI for the evaluation of obesity. Other criteria of evaluating abdominal obesity such as abdominal circumference (considered as one of the components of metabolic syndrome), visceral fat (which results in the production of resistin), and smoking should perhaps also be considered, along with the simultaneous presence of other components of the metabolic syndrome (hyperlipidemia, hypertension, insulin resistance, and a prothrombotic status).

The lack of correlation between PASI and BMI in obese subjects in our study reminds us that although the prevalence of metabolic syndrome seems to rise with the increase in the prevalence of obesity, obesity itself might not be a sufficient factor to determine the relationship between BMI and PASI. Hence, it seems that evaluating other components of the metabolic syndrome is worth considering when investigating the relationship between BMI and the severity of psoriasis.

Although obesity and agents secreted from adipose tissues can be prerequisites for the onset of psoriasis, the psychological burden of psoriasis particularly in its more severe phases can be associated with eating disorders that lead to obesity [23,24]. To eliminate the aforementioned associations, it is suggested to evaluate the relationship between BMI and PASI score as soon as the diagnosis of psoriasis is confirmed, prior to the administration of systemic therapy. We think that the correlation between PASI and BMI could be affected by the use of systemic drugs, particularly anti-TNF agents. In fact, several studies have shown the impact of anti-TNF therapy on BMI and weight gain [25-27]. In our study, none of the patients had a history of administration of anti-TNF-α. Therefore, perhaps the effect of BMI on the severity of psoriasis shown in previous studies can be explained by the influence of systemic drugs.

CONCLUSION

The relationship between BMI and PASI was only significant in psoriatic patients who had normal weight or were overweight. To reduce the effect of factors such as systemic treatments, it is suggested to evaluate the relationship between BMI and PASI score as soon as the diagnosis of psoriasis is confirmed. Also, it is recommended that future studies with larger sample sizes assess all aspects of obesity including BMI, waist circumference, and other components of the metabolic syndrome. Furthermore, the assessment of psychological aspects like eating disorders, smoking habitus, and alcohol consumption is recommended when studying the relationship between obesity and the severity of psoriasis.

Conflicts of Interest: None declared.

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