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Relationship between body mass index and degree of adult psoriasis

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Abstract

Because of the current inconsistencies in the association between body mass index (BMI) and psoriasis severity, this study aimed to determine aforementioned association. This analytical observational study was conducted in a private hospital in West Java between August and December 2023 using data from medical records of 108 psoriasis cases recruited by simple random sampling. Data were collected on demographic characteristics (age, gender), BMI, and psoriasis severity. BMI was divided into categories following the WHO Asia Pacific region classification. Psoriasis severity was categorized as mild, moderate, and severe, and determined by means of Psoriasis Area and Severity Index (PASI) scores. Data were analyzed by independent t test and Chi-squared tests. Mean age (± SD) of psoriasis subjects was 40.1 ±12.4 years, the most frequent gender was female with 73 (67.6%) subjects, and mean BMI was 25.2 ± 3.3 kg/m^2. Fifty-six (51.9%) subjects were obese according to BMI, 24 (22.2%) subjects were overweight, and 28 (25.9%) subjects were of normal weight. A total of 47 (43.5%) subjects had severe psoriasis, followed by moderate psoriasis in 36 (33.3%) subjects, and mild psoriasis in 25 (23.1%) subjects. There was no significant correlation of BMI with psoriasis severity in subjects of productive age (p = 0.249). Healthy lifestyle and weight control are necessary in the management strategy of persons with psoriasis, because of the high prevalence of persons with psoriasis and obesity.

Keywords: Psoriasis; BMI; PASI score; Obese

1. Introduction

Psoriasis is a chronic inflammatory disorder with increased numbers of Th1, Th17, and Th22 cells, leading to the synthesis of interferon-γ, tumor necrosis factor (TNF)-α, interleukin (IL)-6, and IL-22 (1). Psoriasis is found in 1-3% of the global population (2), with prevalences in adults differing between countries but ranging from 0.51% to 11.43% (3). A cross-sectional study found a psoriasis prevalence of 2,5% in Indonesia (4). Psoriasis has no effective treatment, but although this disorder is not contagious, it leaves unsightly scars over the whole body, and has negative effects on the subjects' quality of life (QoL) (5). The etiology of psoriasis is currently not known with certainty, but there are many factors that play a role, such as immunological, genetic, and environmental factors (emotional stress, smoking, life style, diet, physical activity, and infections) (6). The Psoriasis Area and Severity Index (PASI) is most commonly used in clinical trials for grading severity of psoriatic lesions and therapeutic outcomes (7).

Obesity is a significantly challenging public health problem because of the difficult management and the monetary burden of comorbidities (8). Recently the prevalences of overweight and obesity have increased, including in Indonesia, where 1 of 3 adults (35.5 percent, or 64.4 million) are overweight or obese (9). Studies have shown the possibility of a multifactorial correlation of obesity with psoriasis in the progress of these two disorders, with the stress on the important factors of dietary intakes, style of living, genetics, and the microbiome, because these disorders are possibly associated with chronic inflammation (10). The diagnosis of obesity may be established by calculating body mass index

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(BMI), which is weight (kg) divided by height (m) squared. In Indonesia, as in the present study, the BMI categories are those defined by the WHO Asia Pacific region (11).

The correlation of BMI with psoriasis severity is still unclear. Sobhan et al. [20] reported no correlation of BMI with psoriasis severity, but Alizadeh et al. [12] found a significant correlation of BMI with PASI only in normal weight or overweight psoriatic subjects. Czarnecka et al. [13] showed no significant association between normal BMI (<25 kg/m^2) and psoriasis severity, but found a significant association between abnormal BMI (≥ 25 kg/m^2) and PASI. These differing study results may have been caused by differences in BMI criteria and PASI scores in each of the previous studies. Because of the inconsistencies of previous study results on the correlation of BMI with psoriasis severity, there is a need for a study on the association between these parameters. The results of such a study may be of benefit in formulating policies for the management of persons with psoriasis in Indonesia.

2. Materials and Methods

This analytical observational cross-sectional study was conducted in a private hospital in Bogor City, West Java, between August and December 2023. Data of 104 subjects with psoriasis were collected from the medical records that had been selected by simple random sampling. The inclusion criteria were completeness of medical records of psoriasis cases having complete data on age, gender, weight, height, and extent of psoriasis, whereas the exclusion criteria were history of infection, habitual drinking (of alcoholic beverages), and smoking.

The number of study subjects (sample size) was calculated with (1) the formula for an infinite (unknown) population and (2) the formula for a finite (known) population:

$$n_0 = \frac{(Z\alpha^2)\ x\ p\ x\ q}{d^2} \text{ .....(1)}$$

where n0: required optimal sample size, Zα: 1.96; p: prevalence of psoriasis at productive age = 0.025; q: (1-p) = 0.975; determined degree of confidence/measurement accuracy = 0.01, therefore the number of subjects obtained was 84.

$$n = \frac{n_0}{1+(n_0/N)} \text{ ....(2)}$$

It is known that the number of subjects with psoriasis (N) at the data collection site was 550. By using the abovementioned formula and adding an anticipated 15 percent dropouts, the required sample size was 97.

The data were secondary data from medical records of psoriasis cases in the aforementioned hospital. Productive age was defined as the age range of 15-64 years, and was categorized into adolescent age (15-25 years), adult age (26-45 years), and advanced age (46-64 years). Gender was divided into male and female. BMI was calculated as weight in kilograms divided by height in meters squared (kg/m^2) and classified into 4 groups using WHO Asia-Pacific BMI categories, namely underweight (<18.5 kg/m^2), normal weight (18.5–22.9 kg/m^2), overweight (23–24.9 kg/m^2), and obese (≥25 kg/m^2)(11). Psoriasis severity was calculated from PASI score and categorized into mild psoriasis: < 5, moderate psoriasis: 5 – 10, and severe psoriasis: >10 (7).

The categorical data of age, gender, BMI, and psoriasis severity were presented as percentages. Normality of data distribution was tested with the Kolmogorov-Smirnov test. Numerical data were presented as mean ± SD and median (IQR). The correlation of BMI with psoriasis severity was analyzed with the Chi-squared test at $p<0.05$. Data were processed by means of the SPSS statistical program version 25.

3. Results and Discussion

The 108 study subjects had a mean age of 40.1± 12.4 years, the majority or 61 subjects (56.5%) were 26-45 years old and 73 (67.6%) subjects were of female gender. Most subjects namely 56 (51.9%) had a BMI in the obese category. Psoriasis severity in the majority of subjects or 47 subjects (43.5%) was severe psoriasis. There were no gender differences in the categories of age ($p = 0.860$), BMI ($p = 0.281$), and psoriasis severity ($p = 0.604$) (Table 1).

Table 1 Distribution of subject characteristics (n=108)

Variable		Gender		p-value
	Total number of subjects	Male, n(%)	Female, n(%)	
Age (years), mean ± SD	40.1 ± 12.4	39.97±13.3	40.12 ±12.0	0.953[b]
Age categories, n(%)				
Adolescent	11 (10.2)	3 (27.3)	8 (72.7)	
Adult	61 (56.2)	21 (34.4)	40 (65.6)	0.860[b]
Elderly	36 (33.3)	11 (30.5)	25 (69.4)	
BMI (kg/m^2), mean ± SD	25.17 ± 3.78	24.5 ± 2.6	25.5 ± 3.5	0.127[a]
BMI categories, n(%)				
Normal	28 (25.9)	8 (7.4)	20 (18.5)	
Overweight	24 (22.2)	11 (10.2)	13 (12.1)	0.281[b]
Obese	56 (51.9)	16 (14.8)	40 (37.0)	
Severity of psoriasis, mean ± SD	14.4 ± 12.5	13.7 ± 13.2	14.8 ± 12.3	0.689[a]
Categories of severity of psoriasis, n(%)				
< 5	25 (23.1)	11 (10.2)	14 (13.0)	
5 - 10	36 (33.3)	9 (8.3)	27 (25.0)	0.604[b]
>10	47 (43.5)	15 (13.9)	32 (29.6)	

Notes: BMI = body mass index; PASI = psoriasis area and severity index. Age categories: adolescents (15-25 years), adults (26-45 years), elderly (46-64 years). BMI categories: normal weight (18.5-22.9 kg/m^2), overweight (23-24.9 kg/m^2), obese (≥25 kg/m^2). Psoriasis severity was determined by psoriasis area and severity index (PASI) with categories: mild < 5, moderate 5-10, severe >10. Statistical analysis: [a] independent t-test, [b]Chi-squared test, $p<0.05$ = statistically significant

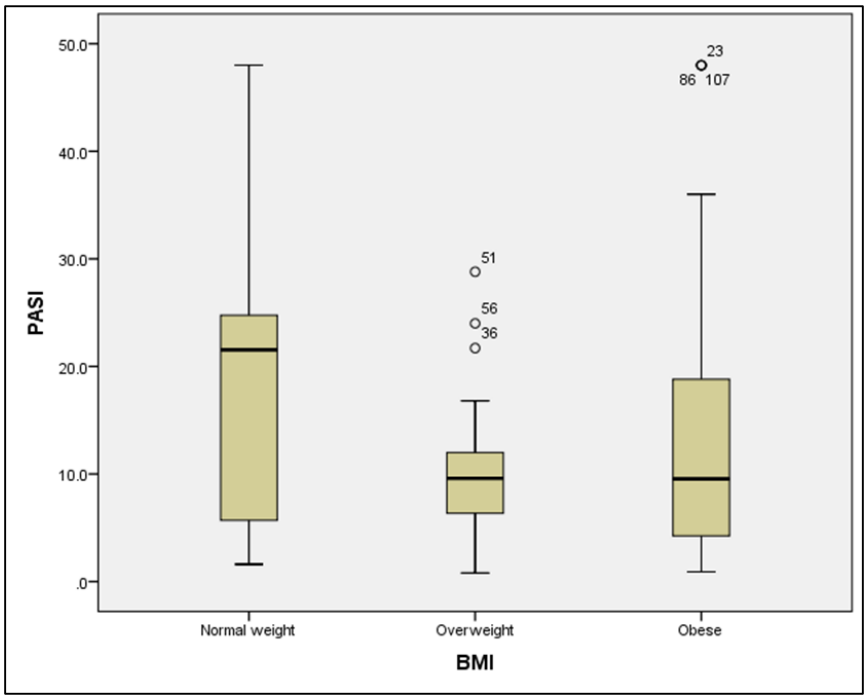

Figure 1 Boxplot of median PASI and BMI status

In Figure 1 may be seen the boxplot of PASI scores and BMI status of the study subjects. In all three BMI categories, it is apparent that the medians in the boxplot are not symmetrical, which shows that the PASI scores are not normally distributed. The medians (IQR) of the PASI scores by respondents' BMI are listed in Table 2.

Table 2 shows psoriasis severity by BMI, where among the subjects with normal and obese BMI, there were more who had severe psoriasis at 16 (57.1%) and 23 (41.1%) subjects, respectively, whereas among subjects with overweight BMI there were 11 (45.8%) who had moderate psoriasis. There was no significant correlation of BMI with psoriasis severity ($p = 0.249$).

Table 2 Correlation of body mass index with psoriasis severity (n= 108)

BMI (kg/m^2)	PASI score, median (IQR)	Psoriasis severity			p-value
		Mild (n%)	Moderate (n%)	Severe (n%)	
Normal weight	21.5 (19.3)	6 (21.4)	6 (21.4)	16 (57.1)	0.49
Overweight	9.6 (5.8)	5 (20.8)	11 (45.8)	8 (33.3)	
Obese	9.5 (4.9)	17 (30.4)	16 (28.6)	23 (41.1)	

Notes: IQR = interquartal range. BMI categories = normal weight (18.5-22.9 kg/m^2), overweight (23-24.9 kg/m^2), obese (≥25 kg/m^2). Psoriasis severity = PASI score: mild < 5, moderate = 5-10, severe >10. Data analysis was by chi-squared test at $p<0.05$.

Our study shows that among 108 subjects with psoriasis, 56 subjects (51.9%) had obese BMI. Obese subjects with psoriasis had a higher prevalence in our study than in a Polish cohort study which found an obesity prevalence of 37.41% in subjects with psoriasis (12). Our study results confirm that obesity is a serious health burden in psoriatic subjects and show that subjects with psoriasis are predisposed to high BMI.

A number of previous studies stated increased BMI to be correlated with greater risk of psoriasis. The retrospective cohort study of Norden et al. (13) showed that as BMI increases, so does psoriasis risk. In comparison with subjects of normal weight or underweight, the risk of psoriasis in overweight and class 1 – 3 obese subjects increased by 19, 43, and 83 percent, respectively. In a cohort study in Taiwan, subjects with BMI ≥30 kg/m^2 had a greater risk of both non-arthritic psoriasis and psoriatic arthritis.(14) The study conducted by Smith et al.(15) found greater risk of psoriasis to be significant only in subjects with BMI 25 - 29.99 (adjusted odds ratio [aOR] = 1.34; 95%CI = 1.02–1.76; $p = 0.04$). However, no significant association was seen between psoriasis and BMIs of 30 or higher (aOR = 1.00; 95%CI = 0.73–1.38; $p = 0.99$). A meta-analysis of prospective studies showed a clear dose-response correlation of BMI with relative risk (RR) of psoriasis, namely for each 5 unit rise in BMI, psoriasis RR increased by 19 percent. Similarly for WC and WHR, RR of psoriasis rose by 24 percent and 37 percent, respectively, for each 10 cm increment in WC and 0.1 unit increment in WHR. Weight was also correlated with psoriasis RR, each 5 kg weight gain increasing psoriasis RR by 11 percent (16). The correlation of BMI with risk of psoriasis may most probably be explained by increased levels of adipokines, including resistin, in the overweight, leading to a proinflammatory state(17).

Overweight and obesity in Indonesia have of late increased in all age groups, e.g. in 2018, overweight and obesity was present in 1 out of 5 school-age children (20 percent, or 7.6 million), 1 out of 7 adolescents (14.8 percent, or 3.3 million), and 1 out of 3 adults (35.5 percent, or 64.4 million) (9). The fact that subjects with psoriasis in our study had a high prevalence of obesity is of grave concern, because of the impact on health from emerging non-communicable diseases, management problems, and monetary burden of comorbidities (8, 9).

In psoriasis, there are differences in epidemiology, degree, comorbidities, and therapeutic adherence between men and women, that may be explained by several complex mechanisms, such as differing skin anatomy and physiology, as well as hormonal, genetic, epigenetic, social, cultural, ethnic, and environmental factors (18). Our study results show that gender-based stratification based on mean PASI score and frequency of severe psoriasis as seen from the PASI score, resulted in a higher mean PASI score and prevalence of severe psoriasis (PASI score ≥10) in women as compared with men, which difference was however statistically not significant (Table 1).

Our study results agree with those of Sobhan et al.(19), who reported no significant correlation of gender with psoriasis severity. However, our results are not in line with the results of Duarte et al.(20), showing both mean PASI scores and prevalence of severe psoriasis (PASI score ≥10) to be greater in men than in women at 9.2 ± 8.3 v. 6.7 ± 6.9 ($p = 0.03$)

and 37.8% v. 26.5%, respectively. The differences between our study results and those of Duarte et al.(20) may have been caused by differences in subjects' mean PASI scores and BMI in both studies. In our study we found higher frequencies of obesity in women than in men (37 percent v. 14.8 percent). The clinical impact of female gender and BMI obesity category in our study may result in a greater risk of treatment cessation as well as adverse drug reactions. A meta-analysis by Mourad et al. (21) showed that the hazard ratios (HR) of obesity and female gender were 1.21 and 1.22, respectively, in predicted treatment discontinuation therapy due to ineffectiveness and adverse events. Women have twice the frequency of adverse drug reactions (ADR) than men (HR=2.16) (21, 22). The causative mechanisms are still rather unclear, but gender differences in pharmacokinetics are significantly associated with toxicities that are specific for women (22).

We failed to find a significant correlation of BMI with psoriasis severity, thereby agreeing with Sobhan et al.(19) and differing solely in p-values. On the other hand, Alizadeh et al. (23) found the association between BMI and PASI to be significant only in psoriatic subjects with normal weight or overweight ($r = 0.369$, $p = 0.006$ and $r = 0.287$, $p = 0.019$, respectively). An observational study conducted by Czarnecka et al. (12) found no significant association between normal BMI (<25 kg/m^2) and psoriasis severity ($r = -0.001$. and $p = 0.917$), but found a statistically significant association between abnormal BMI (≥ 25 kg/m^2) and PASI score ($r = 0.23$, and $p = 0.016$). Li et al. (24) observed that overweight or obese subjects with psoriasis had significantly more severe psoriatic lesions and metabolic comorbidities. Therefore the study results on the correlation of BMI with psoriasis severity are still inconsistent.

Obesity and psoriasis are two chronic inflammatory disorders with circular feedback and a degree of synergy. There is increased inflammation in obesity as reflected in the higher levels of pro-inflammatory adipokines, such as IL-17A and IL-23, i.e. essential mediators in psoriasis but not extensively studied in obesity (17). In addition, the risk of obesity may be proportional to the degree of psoriasis, higher psoriasis severity possibly indicating greater risk of obesity (25).

By itself BMI does not accurately reflect adiposity as measured by fat storage levels, because normal or minimally increased BMI may coexist with excessive adiposity and the resultant chronic inflammation (17). The finding in our study of a weak correlation between BMI and psoriasis severity may have been caused by the relatively lower BMI of Indonesians in comparison with that of Caucasians in Europe and the US. Abdominal obesity (waist circumference [WC] and waist-to-hip ratio [WHR]) is more strongly associated with visceral fat than is BMI (26). However, whether this relationship of abdominal obesity with visceral fat holds true in the Indonesian population is unclear.

In Brazil, Duarte et al. (20) evaluated the association of psoriasis severity with excessive weight by determining various parameters. The investigators found a direct association of PASI scores with BMI ($r = 0.0154$, $p = 0.01$) and with WC ($r = 0.207$, $p = 0.001$). WHR was also associated with BMI. ($r = 0.164$, $p = 0.007$). The investigators concluded that obesity and psoriasis are interconnected in Brazil and that high BMI values do not automatically indicate high visceral fat (20). Psoriasis severity is correlated with excessive weight, particularly with centripetal obesity (20). Future studies may explore other indicators of overweight or obesity and the potential synergistic association between obesity and psoriasis severity, such that treatment regimens may become more optimal.

The treatment of obese psoriatic subjects faces many challenges and should be applied holistically and individually. Because of the interaction between psoriasis and obesity, therapeutic management of both disorders should particularly include lifestyle changes and weight reduction, thereby assisting the individual with psoriasis and improving pharmacological therapeutic efficacy. Weight reduction is recommended for overweight or obese psoriatic persons. The Mediterranean diet (27), or other alternatives following a very low-calorie ketogenic diet (VLCKD)(28) possibly lowers psoriasis severity by weight loss and decrease in chronic inflammation. To reduce their obesity, obese persons with psoriasis should perform aerobic exercises of ≥30 minutes 3-5 times weekly, thereby effecting a weight loss of approximately 1 kg per month through dietary management (29). Weight reduction in psoriatic persons through diet and lifestyle changes also positively impacts disease severity and treatment response (30).

Obesity and psoriasis comorbidity poses a therapeutic challenge, because obese psoriatic persons can use only few topical preparations, in view of their greater skin surface area and the higher cost of the drugs. Pirro et al. (31) showed that obesity (BMI ≥ 30 kg/m^2) has a negative effect on the clinical response of psoriatic persons toward biological drugs such as anti-interleukin and anti-tumor necrosis factor drugs, the latter being less affected by BMI than the former. From studies on drug pharmacokinetics, it appears that excessive weight has a negative influence on drug clearance and distribution, that depend on their lipophilic properties. Furthermore, the number of contraindications may increase because of adverse reactions to the drugs, e.g. hyperlipidemia on systemic administration of acitretin or hepatic steatosis in case of methotrexate (12).

In addition, vitamin D signaling may be essential for the course of psoriasis (32). In connection with the assumption of psoriasis as an immunological disorder, possibly vitamin D deficiency constitutes an environmental factor (32) and is associated with psoriasis severity (33, 34). Although Indonesia is a tropical country with abundant sunshine, vitamin D deficiency is highly prevalent (35). Screening for vitamin D is required in persons with psoriasis, because of the regulatory effects of vitamin D on immunity and on keratinocyte proliferation and maturation (36).

Our finding of a high prevalence of obesity calls for intervention, because obesity is a known cardiovascular risk factor that is connected with metabolic abnormalities. Furthermore, it is known that there is crosstalk between obesity and psoriasis, such that the management strategy for obese persons with psoriasis consists not only of pharmacotherapy but should also include changes to a healthy lifestyle and weight control.

The limitations of our study are as follows: (i) Our study was cross-sectional, without any possibility of determining which variables are the causes and which the effects, thus necessitating confirmation by further large-scale studies. (ii) Criterion validity is restricted by the lack of a "gold standard" of psoriatic severity (7). PASI scores depend heavily on the experience of the interviewers, creating problems of inter-rater reliability (7). However, this effect is presumably minimal, because our data on psoriasis severity come from medical records, whose classifications had been determined by specialists in dermatology. (iii) To reduce the effect of systemic treatments, the association between BMI and PASI score should be determined directly upon confirmation of the diagnosis of psoriasis.

4. Conclusion

No association was found between BMI and psoriasis severity. The high prevalence of obesity in psoriatic subjects should be managed by healthy lifestyle strategies for weight control.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors do not have any conflict of interest to declare.

Statement of ethical approval

This study received ethical clearance from the Research Ethics Commission of the Faculty of Medicine, Universitas Trisakti, under no. 147/KER-FK/VII/2023.

Statement of informed consent

Informed consent was obtained from all participants included in the study.

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