

Research Article

The Relationship between Eating Styles and the Severity of Psoriasis: A Cross-Sectional Study in Thailand

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Background. Psoriasis, a persistent inflammatory condition, is linked to several concurrent health issues. Among these, obesity stands out as a significant contributing factor, significantly influencing the development and seriousness of psoriasis. Furthermore, behavioral elements such as eating styles could potentially contribute to the activity of the disease. **Objective.** To investigate the relationships between eating styles and the clinical severity of psoriasis. **Materials and Methods.** A cross-sectional study among 158 chronic plaque psoriasis patients was conducted. Sociodemographic data and clinical presentation of psoriasis including risk factors and treatment, eating, stress, and sleep data were obtained from questionnaires. Psoriasis disease severity, weight, and height measurements, including bioelectrical impedance analysis were assessed. A multivariate logistic regression analysis was employed to assess eating patterns and identify notable factors linked to the severity of the disease. **Results.** After adjusting for the potential confounder, the emotional eating style was significantly associated with an increase in risk of psoriasis severity when compared to the restrained eating style (odds ratio, 3.9; 95% confidence interval, 1.52–9.81). Body mass index, body fat mass, eating attitude, alcohol consumption, nail involvement, psoriasis treatment, smoking status, duration of sleep, and stress status were not significant risk factors for disease severity. **Conclusions.** There is a significant correlation between emotional eating style and the severity of chronic plaque-type psoriasis in Asian patients. Further exploration into utilizing cognitive-behavioral therapy to address emotional eating styles as part of psoriasis management is warranted.

1. Introduction

Psoriasis possesses a multifaceted and intricate origin, representing a condition influenced by multiple factors that is linked to a number of serious comorbidities such as metabolic syndrome, obesity, diabetes, and cardiovascular disease with shared chronic systemic inflammation [1]. Psoriasis is developed as a result of genetic susceptibility, environment, and lifestyle factors including nutritional factors. Obesity, drinking, smoking, sleep disturbance, and mental stress may exacerbate psoriasis. Nutrition can play a crucial role both in disease pathogenesis and severity. Lifestyle modification such as healthy eating, optimal exercise, adequate rest, maintain healthy weight, and limited

use of tobacco and alcohol consumption can help improve psoriasis severity and comorbidities [2]. Maintaining a healthy eating behavior has been emphasized as one of the behavioral modification.

One of the eating behavior aspect which correlates to weight gain and high calorie consumption is the eating style [3]. The eating styles are classified into three categories including emotional, external, and restrained style. Emotional eating pertains to the consumption of excessive food in response to negative emotions, such as anxiety or irritability. This eating style is related to body weight fluctuation, binge eating, disruption of weight loss effort, and depression. The external eating is a hypersensitive response to external food cues such as the sight or scent of appetizing

food. Overeating and impulsivity are related to external eating styles. Restrained eating is characterized as an individual's conscious effort to limit food consumption as a means of controlling body weight. However, when cognition is disinhibited, restrained eaters are more likely to overeat, leading to weight gain [4]. However, the association between eating styles and psoriasis remains uncertain.

The objective of this study was to examine the association between three eating styles and the severity of psoriasis, while accounting for all potential confounding factors.

2. Materials and Methods

This study was performed among 158 patients with psoriasis from August to December 2021 at Vajira Hospital, Bangkok, Thailand. All patients, age of 18 years and older, with chronic plaque psoriasis confirmed by the dermatologist were included. Patients with other types of psoriasis such as pustular, erythrodermic, or guttate psoriasis were excluded. A verbal explanation of the study was given to all eligible participants and all participants were provided with a written informed consent at enrollment. The Institutional Review Board of Navamindradhiraj University approved this study (approval number COA 026/2564).

Personal demographic and health-related characteristic questionnaires were designed. The details of questionnaires included various aspects such as age, gender, smoking habits, alcohol consumption, daytime and nocturnal sleep duration, psoriasis duration, and treatment modalities. Nail and joint involvement were based on the patient's medical record and direct clinical examination. Nocturnal sleep duration was measured by the question "During the past month, how many hours of actual sleep did you get at night?" Nocturnal sleep was divided into three categories: short (<7 hours), moderate (7–9 hours), and long (>9 hours). Daytime sleep duration was measured by the question "During the past month, how long did you take a nap during the day?" Daytime sleep was divided into three groups: 0 hours, >0 minutes and ≤30 minutes, and >30 minutes [5].

Anthropometric measurements were taken with all subjects wearing light clothes without shoes. Height was measured by WB3007301 model of TANITA scale (Tanita Corp., Tokyo, Japan). Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared (kg/m^2). The BMI was categorized into three groups based on BMI cut-off points: <25 kg/m^2 , 25–29.99 kg/m^2 (overweight), and ≥ 30 kg/m^2 (obesity) [6]. Body composition analysis data were obtained from InBody720 model of bioelectrical impedance analyzer (InBody Co., Ltd, Seoul, Korea). The patient voided and stood on the device after at least 8 to 12 hours of fasting. The device captured body weight, age, height, and gender. Total body weight was the sum of fat mass and fat free mass. Body fat percentage calculated the percentage of fat mass within the total body weight. Obesity was defined as body fat percentage more than 25% in males and 35% in females [7].

The clinical severity of psoriasis was determined by Psoriasis Area and Severity Index (PASI), which is a numerical score ranging from 0 to 72 as qualitative measurement of the average erythema, infiltration, and

desquamation of the lesions, weighted by the area of involvement. Severity of psoriasis was categorized into three groups. Mild disease severity was defined as the PASI score ≤6, the PASI score >6 and >10 were considered as moderate and severe disease, respectively [8]. In addition, Thai-Eating Style Scale (T-ESS), Eating Attitudes Test-26 (EAT-26) Thai version, and Thai Stress test (TST) were evaluated.

T-ESS consisted of 31 items, 12 of which measure emotional eating style, 8 of which measure external eating and 11 of which measure restrained eating, all of which were rated on a five-point Likert type scale (1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Often, and 5 = Always). In this study, eating styles of each participant were categorized into three domains, with the highest subscale score indicating the greatest endorsement of each particular eating style [9].

EAT-26 was used for assessing eating disorders in the general population. The EAT-26 consisted of 26 items asking about eating behavior characteristics rated on a six-point Likert type scale related to how often an individual behaves (Never, Rarely, Sometimes, Often, Usually, and Always). Items 1–25 were scored on a 4-point scale with (Others = 0, Often = 1, Usually = 2, and Always = 3). Item 26 was reverse scored and a final score was calculated by summing items 1–26. A cut-off score of 12 was indicative of eating disorder tendencies [10].

TST had 24 questions describing psychological reactions in both positive and negative feelings in relation to events occurring in daily life. The TST rated on a three-point Likert type scale (0 = Never, 1 = Sometimes, and 3 = Often). Responses to questions assessing negative feelings (items 1–12) and positive feelings (items 13–24) were separately calculated then stress status was categorized using the matrix table. The TST was divided into four categories: high stress status (scores 7–9), mild stress (scores 5–6), normal mental health (scores 2–4), and excellent mental health (score 1) [11].

The quantitative variables were described as mean ± standard deviation (SD) or median and interquartile range (IQR). The categorical variables were described as number and percentage. The binary logistic regression model was used to calculate odds ratios (OR) and 95% confidence interval (CI) for comparison of eating styles and all potential confounding factors between psoriasis patients with mild disease and those with moderate to severe disease. The crude associations were calculated first and then the variables that showed statistically significant differences between the groups were adjusted. All analyzes were performed using STATA statistical software version 13 (Stata Corp., College Station, TX, USA). Statistical significance was determined as $P < 0.05$.

3. Results

Of the 158 patients with chronic plaque psoriasis, the mean age ± SD was 53.6 ± 15.2 years and the median BMI was $25.7 \text{ kg}/\text{m}^2$ (IQR 23.0–29.3). The median nocturnal sleep duration was 7 hours (IQR 6–8) and median daytime sleep duration was 0 hours (IQR 0–1). The median PASI score was 3.7 (IQR 2.5–6.1) and median disease duration was

10.0 years (IQR 7.0–20.0). Joint involvement was reported in 39 of 116 mild psoriasis (33.6%) and 27 of 42 moderate to severe psoriasis (64.3%). Nail involvement was detected in 29 of 116 mild psoriasis (25.0%) and 17 of 42 moderate to severe psoriasis (40.5%). The majority of patients received topical treatment in which topical corticosteroids were the most commonly used. Of 35 patients who received systemic treatment, 28 (80.0%), 4 (11.4%), 2 (5.7%), and 1 (2.9%) patients were prescribed methotrexate, acitretin, cyclosporine, and methotrexate combined with cyclosporine, respectively. None of the patients received phototherapy or biologic agents. Table 1 summarizes the baseline clinical characteristics of the study population.

The univariate analysis revealed that patients with joint involvement were significantly associated with an increased risk of more severe psoriasis while the patients with nail involvement tended to increase the risk. Table 2 shows the factors associated with the severity of psoriasis.

The univariate and multivariate correlations between eating styles and psoriasis severity are shown in Table 3. Patients who had predominant emotional eating had significantly more moderate to severe psoriasis (OR, 4.6; 95% CI, 1.86–11.24) compared with restrained eating. The association remained significant with similar estimated effects after adjusting for joint involvement (adjusted OR, 3.9; 95% CI, 1.52–9.81).

4. Discussion

This study demonstrates that psoriasis patients with emotional eating style experience greater severity compared to other eating styles. After adjusting the significant associated factor, psoriasis patients with emotional eating style was 3.9 times more likely to exhibit greater psoriasis severity compared to those with restrained eating style. Meanwhile, psoriasis patients with external type eating showed nonsignificant association with the more clinical severity compared to the restrained eating style.

Psoriasis is a chronic inflammatory and immune mediated disease, caused by the interplay between various genetic and environmental factors. Sustained inflammation leads to activation of keratinocyte proliferation and differentiation including dysregulation of the immune system. The results of the major inflammatory cytokines, interferon alpha (IFN- α), IFN- γ , tumor necrotic factor alpha (TNF- α), interleukin-1 (IL-1), IL-6, IL-17, IL-22, etc., increase the severity of disease and also cause other systemic associated comorbidities [12]. Obesity, one of comorbid diseases, is associated with chronic inflammation. Most of the obese patients have exceed body fat mass or adipose tissues. These adipose tissues secrete various proinflammatory mediators such as TNF- α , IL-1, and IL-6 and also numerous adipokines such as leptin, visfatin, and resistin [13]. The major roles of leptin are appetite controller and immune regulators. In obese patients, there is an increase in leptin level with altered proper functions called leptin resistant state. In this state, the increase in food intake and the more inflammatory cytokines, TNF- α , IL-1, and IL-6, were demonstrated. Leptin can also induce the T-helper cells and neutrophils infiltration into the skin causing psoriasis disease

TABLE 1: Baseline clinical characteristics, eating styles, eating attitudes, and stress status of psoriasis patients ($n = 158$).

Variables	Category	N	Percent
Age (years)	18–39	30	19.0
	40–59	66	41.8
	≥ 60	62	39.2
Gender	Male	94	59.5
	Female	64	40.5
Duration of psoriasis (years)	1–5	34	21.7
	6–15	73	46.5
	>15	50	31.9
Body mass index (kg/m ²)	<25	69	43.7
	25–29.9	55	34.8
	≥ 30	34	21.5
Body fat mass (percentage)	Male <25	44	27.9
	Female <35		
	Male ≥ 25	114	72.1
	Female ≥ 35		
Smoking status	Never	120	76.0
	Former	17	10.8
	Current	21	13.3
Alcohol consumption	Never	107	67.7
	Former	38	24.1
	Current	13	8.2
Nocturnal sleep duration	Short (<7 hours)	55	35.3
	Moderate (7–9 hours)	95	60.9
	Long (>9 hours)	6	3.8
Daytime sleep duration	0 hours	90	57.7
	>0 minutes and ≤ 30 minutes	8	5.1
	>30 minutes	58	37.2
Severity of psoriasis	Mild (PASI ≤ 6)	116	73.4
	Moderate (PASI 6–10)	26	16.5
	Severe (PASI >10)	16	10.1
Joint involvement	No	92	58.2
	Yes	66	41.8
Nail involvement	No	112	70.9
	Yes	46	29.1
Psoriasis treatment	No treatment	7	4.5
	Topical treatment	115	73.2
	Topical + systemic treatment	35	22.3
Stress status	Normal mental health	38	24.0
	Mild stress status	78	49.4
	Stressful status	42	26.6
Eating attitude test-26	<12	123	77.9
	≥ 12	35	22.1
Eating styles	Emotional eating	22	13.9
	External eating	31	19.6
	Restrained eating	94	59.5
	Combined	11	7.0

Total number may vary because of missing values.

flare up [14]. The roles of visfatin and resistin were found to increase in innate and adaptive immune function, resulting in secretion of proinflammatory cytokines [15].

Individuals exhibiting emotional eating tendencies tend to gravitate towards consuming high-density foods and engage in eating as a response to negative emotions, such as sadness,

TABLE 2: Association between risk factors and clinical severity of psoriasis in 158 psoriasis patients.

Variables	Category	OR (95% CI)	P value
Age (years)	18–39	1.0 (reference)	
	40–59	1.50 (0.53–4.27)	0.447
	≥60	1.64 (0.57–4.67)	0.358
Gender	Male	1.0 (reference)	
	Female	0.66 (0.32–1.38)	0.271
Duration of psoriasis (years)	1–5	1.0 (reference)	
	6–15	0.59 (0.24–1.45)	0.250
	>15	0.90 (0.35–2.29)	0.819
Body mass index (kg/m ²)	<25	1.0 (reference)	
	25–29.9	0.71 (0.32–1.58)	0.400
	≥30	0.70 (0.27–1.81)	0.465
Body fat mass (percentage)	Male <25	1.0 (reference)	
	Female <35		
	Male ≥25	1.33 (0.59–3.00)	0.496
	Female ≥35		
Smoking status	Never	1.0 (reference)	
	Former	1.5 (0.51–4.39)	0.459
	Current	0.65 (0.20–2.07)	0.463
Alcohol consumption	Never	1.0 (reference)	
	Former	0.96 (0.42–2.22)	0.925
	Current	0.81 (0.21–3.14)	0.757
Nocturnal sleep duration (hrs)	Short (<7)	1.0 (reference)	
	Moderate (7–9)	0.71 (0.34–1.50)	0.372
	Long (>9)	0.45 (0.48–4.12)	0.478
Daytime sleep duration	0 hrs	1.0 (reference)	
	>0 mins and ≤30 mins	0.50 (0.06–4.31)	0.528
	>30 mins	1.84 (0.88–3.84)	0.103
Joint involvement	No	1.0 (reference)	
	Yes	3.55 (1.70–7.44)	0.001
Nail involvement	No	1.0 (reference)	
	Yes	2.04 (0.97–4.30)	0.061
Psoriasis treatment	No systemic treatment	1.0 (reference)	
	Systemic treatment	1.98 (0.89–4.44)	0.095
Stress status	Normal mental health	1.0 (reference)	
	Mild stress status	1.57 (0.63–3.93)	0.337
	Stressful status	1.33 (0.47–3.76)	0.590
Eating attitude test-26	<12	1.0 (reference)	
	≥12	1.14 (0.49–2.63)	0.763

CI, confidence interval; hrs, hours; kg, kilogram; m, meter; mins, minutes; OR, odds ratio.

TABLE 3: Association between eating styles and clinical severity of psoriasis in 158 psoriasis patients.

Eating styles	Univariate analysis		Multivariate analysis*	
	OR (95% CI)	P value	OR (95% CI)	P value
Restrained eating	1.0 [reference]		1.0 [reference]	
Emotional eating	4.58 (1.86–11.24)	0.001	3.86 (1.52–9.81)	0.005
External eating	1.80 (0.77–4.20)	0.172	1.65 (0.69–3.98)	0.260

*Adjusted for joint involvement. CI, confidence interval; OR, odds ratio.

anger, and disappointment [4]. Emotion is one of the predictive factors of weight loss behaviors and impacts on food choices [16]. As a multifactorial disease, psoriasis would be activated by both of mental stress and hyperpalatable diet with foods containing high saturated fats and sugars. There is a positive correlation between mental stress and the consumption of hyperpalatable diets and inflammation [17].

However, this study shows no relation between psoriasis severity and stress status. There was a significant association between a hyperpalatable diet and obesity. The consumption of a hyperpalatable diet was linked to both psoriasis disease activity and heightened levels of inflammatory cytokines [18]. The systematic review showed positive association between hyperpalatable diet and the emotional eating styles [19].

Therefore, the proper eating style is very important to maintain good health especially in psoriasis patient. This study proved that emotional eating style is the worst eating style in psoriasis patient among three eating styles. Previous studies indicated that the rigid form of restrained eating type resulted in obesity more than the flexible eating style [20]. The external eating style was also associated with hyperpalatable diet [21]. Therefore, people with either extreme styles may not necessarily exhibit the most favorable outcomes. The emotional eating style and hyperpalatable food were the independent factors that have strongly linked to each other in psoriasis disease controlling.

Consequently, the objective of treatment in both obesity and psoriasis is to effectively address and overcome over-eating. Cultivating an optimal eating style may play a crucial role. In a recent study, it was observed that participants who reduced their emotional eating tendencies during weight loss programs achieved greater success in their weight loss efforts compared to those who experienced an increase in emotional eating [22]. Future studies should focus on investigating therapeutic approaches aimed at enhancing the well-being of psoriasis patients with emotional eating styles. Potential methods to explore include mindfulness-based eating awareness training, cognitive-behavioral therapy, and the use of food records. The limitations in this study were the lack of biologic markers and daily dietary records. The generalizability of the findings was restricted to chronic plaque-type psoriasis in Asians with mild-to-moderate severity and normal to overweight status.

5. Conclusions

The present study highlighted the significant association between eating styles and disease severity in patients with chronic plaque-type psoriasis. Assessment of eating styles as a risk factor in psoriasis patients is essential. Future studies on eating styles in psoriasis patients could include average daily total calories consumption and its composition. Furthermore, integrating conventional nutritional guidance for dietary recommendations, alongside the assessment and guidance of eating styles, could be an integral part of diet education for patients dealing with psoriasis.

Data Availability

The data presented in this study are available on request from the corresponding author.

Ethical Approval

This study was approved by the Institutional Review Board of the Faculty of Medicine Vajira Hospital (Certificate of Approval: 026/2564).

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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References

- [1] S. Piaserico, G. Orlando, and F. Messina, "Psoriasis and cardiometabolic diseases: shared genetic and molecular pathways," *International Journal of Molecular Sciences*, vol. 23, no. 16, p. 9063, 2022.
- [2] M. L. Musumeci, M. R. Nasca, S. Boscaglia, and G. Micali, "The role of lifestyle and nutrition in psoriasis: current status of knowledge and interventions," *Dermatologic Therapy*, vol. 35, no. 9, p. e15685, 2022.
- [3] A. Betancourt-Núñez, N. Torres-Castillo, E. Martínez-López et al., "Emotional eating and dietary patterns: reflecting food choices in people with and without abdominal obesity," *Nutrients*, vol. 14, no. 7, p. 1371, 2022.
- [4] K. Elfhag and L. C. Morey, "Personality traits and eating behavior in the obese: poor self-control in emotional and external eating but personality assets in restrained eating," *Eating Behaviors*, vol. 9, no. 3, pp. 285–293, 2008.
- [5] Z. Wang, W. Yang, X. Li, X. Qi, K. Y. Pan, and W. Xu, "Association of sleep duration, napping, and sleep patterns with risk of cardiovascular diseases: a nationwide twin study," *Journal of the American Heart Association*, vol. 11, no. 15, Article ID e025969, 2022.
- [6] M. D. Jensen, D. H. Ryan, C. M. Apovian et al., "American college of cardiology/american heart association task force on practice guidelines, obesity society," *Circulation*, vol. 129, pp. S102–S138, 2014.
- [7] Y. Li, H. Wang, K. Wang et al., "Optimal body fat percentage cut-off values for identifying cardiovascular risk factors in Mongolian and Han adults: a population-based cross-sectional study in Inner Mongolia, China," *BMJ Open*, vol. 7, no. 4, Article ID e014675, 2017.
- [8] L. Salgado-Boquete, J. M. Carrascosa, M. Llamas-Velasco, R. Ruiz-Villaverde, P. de la Cueva, and I. Belinchón, "A new classification of the severity of psoriasis: what's moderate psoriasis?" *Life*, vol. 11, no. 7, p. 627, 2021.
- [9] S. Sakulsriprasert, O. Choochom, and N. Supparerkchaisakul, "Validity and reliability of the Thai eating style scale (T-ESS) among Thai female high-school students," *The Journal of The Psychiatric Association of Thailand*, vol. 62, no. 1, pp. 59–70, 2017.
- [10] T. Kaewporndawan, P. Pariwatcharakul, and W. Pimratana, "Criterion validity study of the eating attitudes test-26 (EAT-26 Thai version) among Thai females," *The Journal of The Psychiatric Association of Thailand*, vol. 58, no. 3, pp. 283–296, 2013.
- [11] S. Phattharayuttawat, T. Ngamthipwattana, and K. Sukhatungkha, "The development of the Thai stress test," *The Journal of The Psychiatric Association of Thailand*, vol. 45, no. 3, pp. 237–250, 2000.
- [12] T. Tashiro and Y. Sawada, "Psoriasis and systemic inflammatory disorders," *International Journal of Molecular Sciences*, vol. 23, no. 8, p. 4457, 2022.

- [13] G. Fantuzzi, "Adipose tissue, adipokines, and inflammation," *Journal of Allergy and Clinical Immunology*, vol. 115, no. 5, pp. 911–919, 2005.
- [14] J. Hwang, J. A. Yoo, H. Yoon et al., "The role of leptin in the association between obesity and psoriasis," *Biomolecules & Therapeutics (Seoul)*, vol. 29, no. 1, pp. 11–21, 2021.
- [15] O. Dikbas, M. Tosun, C. Bes, S. B. Tonuk, O. Y. Aksehirli, and M. Soy, "Serum levels of visfatin, resistin and adiponectin in patients with psoriatic arthritis and associations with disease severity," *International Journal of Rheumatic Diseases*, vol. 19, no. 7, pp. 672–677, 2016.
- [16] E. Leigh Gibson, "Emotional influences on food choice: sensory, physiological and psychological pathways," *Physiology & Behavior*, vol. 89, no. 1, pp. 53–61, 2006.
- [17] T. J. Devonport, W. Nicholls, and C. Fullerton, "A systematic review of the association between emotions and eating behaviour in normal and overweight adult populations," *Journal of Health Psychology*, vol. 24, no. 1, pp. 3–24, 2019.
- [18] Z. Shi, X. Wu, S. Yu et al., "Short-term exposure to a western diet induces psoriasiform dermatitis by promoting accumulation of IL-17a-producing $\gamma\delta$ T cells," *Journal of Investigative Dermatology*, vol. 140, no. 9, pp. 1815–1823, 2020.
- [19] C. E. Fuente González, J. L. Chávez-Servín, K. de la Torre-Carbot, D. Ronquillo González, M. D. L. Á. Aguilera Barreiro, and L. R. Ojeda Navarro, "Relationship between emotional eating, consumption of hyperpalatable energy-dense foods, and indicators of nutritional status: a systematic review," *Journal of Obesity*, vol. 2022, Article ID 4243868, 2022.
- [20] J. Westenhoefer, D. Engel, C. Holst et al., "Cognitive and weight-related correlates of flexible and rigid restrained eating behaviour," *Eating Behaviors*, vol. 14, no. 1, pp. 69–72, 2013.
- [21] M. Ferrer-Garcia, J. Gutiérrez-Maldonado, J. Pla-Sanjuanelo et al., "External eating as a predictor of cue-reactivity to food-related virtual environments," *Studies in Health Technology and Informatics*, vol. 219, pp. 117–122, 2015.
- [22] A. Braden, S. W. Flatt, K. N. Boutelle, D. Strong, N. E. Sherwood, and C. L. Rock, "Emotional eating is associated with weight loss success among adults enrolled in a weight loss program," *Journal of Behavioral Medicine*, vol. 39, no. 4, pp. 727–732, 2016.