Journal of Social Research
P-ISSN: 2827-9832
E-ISSN: 2828-335x
http://ijsr.internationaljournallabs.com/index.php/ijsr

The Correlation between Abdominal Circumference and Psoriasis Vulgaris Incidence

Vrenda Alia[1], Muhammad Eko Irawanto[2], Laura Noviani[3], Ivani[4], Nurul Hidayati[5]
Universitas Sebelas Maret, Indonesia[1,2,3,4,5]
Email: dr.vrendaalia@gmail.com, ekokepik@staff.uns.ac.id, novianilaura@gmail.com, ivaniahmad14@gmail.com, dr.nurulhidayati01@gmail.com

ABSTRACT

Psoriasis is a chronic inflammatory skin condition that is often associated with various comorbidities, including cardiovascular disease, obesity, diabetes mellitus, and psoriatic arthritis. Obesity, particularly abdominal obesity, is known to impact the effectiveness of psoriasis treatment. This study aims to explore the relationship between abdominal circumference and the incidence of psoriasis in patients at the Dermatology and Venereology Polyclinic of Dr. Moewardi Hospital, Surakarta. The objective of this research was to determine whether abdominal circumference (waist circumference) is associated with the incidence of psoriasis in patients at the Dermatology and Venereology Polyclinic. A cross-sectional study was conducted with 30 psoriasis vulgaris patients treated at the clinic from July to August 2024. Waist circumference was categorized as high or normal. Data analysis was performed using the Mann-Whitney test and logistic regression analysis. The majority of participants (70%) had high waist circumference. Statistically, only age showed a significant relationship with psoriasis incidence ($p = 0.015$). Gender, BMI status, and waist circumference did not significantly correlate with psoriasis incidence ($p = 0.069$, $p = 0.789$, $p = 0.284$, respectively). This study suggests that waist circumference does not have a significant relationship with the incidence of psoriasis. Future research could explore other factors contributing to psoriasis exacerbation, such as metabolic syndrome or visceral adiposity.

Keywords: abdominal circumference, obesity, psoriasis vulgaris

INTRODUCTION

Psoriasis is a proliferative and chronic inflammatory condition of the skin. Psoriasis is characterized by erythematous plaques covered with silvery scales. Psoriasis predilection is usually on the surface of the extensor, scalp, and lumbosacral region. Psoriasis is a lifelong skin disease that clinically appears in various forms such as plaque, flexure, guttata, pustular, and erythroderma. Psoriasis has a prevalence of 0.1%-3% in various populations, and psoriasis can start at any age but often appears between the ages of 15 and 30. Psoriasis affects both men and women, with early onset in women and those who have a family history of psoriasis. The peak onset is at ages 30-39 years and 60-69 years in men and 10 years earlier in women. The onset and

recurrence of psoriasis can be attributed to genetic, epigenetic, environmental, and lifestyle factors (Egeberg et al., 2020; Gelfand et al., 2021; Armstrong & Read, 2022).

The immune response in psoriasis is characterized by the proliferation of Th1, Th17, and Th22 cells resulting in the production of pro-inflammatory mediators interferon-γ, tumor necrosis factor (TNF)-α, interleukin (IL)-6, and IL-22. The development of psoriasis results from a combination of genetic factors, triggering factors, and epigenetic factors. There are more than 80 genes that have been identified to affect psoriasis, including human leukocyte antigen Cw6 (HLA Cw6), IL-12B, IL-23R, and late cornified envelope 3B/3C. Infection, trauma, stress, and dysbiosis of the skin microbiota are some of the triggering factors for psoriasis (Gudjonsson et al., 2021; di Meglio et al., 2020; Husebye et al., 2021). Smoking can also disrupt the delicate balance of the immune system, leading to dysregulation of the immune response. Smoking can increase the production of pro-inflammatory cytokines, such as TNF-α, IL-6, and IL-17, which are key factors in the pathogenesis of psoriasis vulgaris (Reich et al., 2019; Korkmaz et al., 2020; Holick et al., 2021). Systemic inflammatory status is common in patients with psoriasis accompanied by comorbidities such as cardiovascular disease, metabolic syndrome, obesity, diabetes mellitus, and arthritis psoriasis (Wagner et al., 2021; Leung et al., 2021; Searles et al., 2020).

Obesity plays a fundamental role in skin conditions. Obesity is a significant risk factor for psoriasis vulgaris, potentially affecting the progression and severity of the disease. The most relevant parameters for obesity are the thickness of intra-abdominal fat (visceral adiposity) and an increase in abdominal circumference. Obesity is a risk factor for several skin pathologies, including acanthosis nigrikans, acne, hyperhidrosis, intertriginosa dermatitis, and skin tags. This correlation has been linked to insulin resistance and hyperinsulinemia, in which the innate and adaptive immune systems, pro-inflammatory cytokines, and adipokines are responsible for triggering chronic inflammation (Baba et al., 2020; Ye et al., 2021; Gudjonsson et al., 2021). This condition can alter the skin's physiology in terms of collagen synthesis and structure, sebaceous gland function, sweat glands, and maturation of the skin layer. Other diseases such as rosacea also indicate that obesity is a risk factor for the onset of the disease (Armstrong et al., 2021; Ghosh et al., 2022; Pandya & Che, 2021).

Research on the relationship between psoriasis and obesity has been widely conducted, as obesity has been found to have a significant impact on the effectiveness of psoriasis treatment. Understanding the relationship between these two conditions is essential to develop tailored therapeutic approaches to manage psoriasis and obesity simultaneously. Research on psoriasis and obesity therapy has shown a link between obesity with a low response to systemic treatment and biological agents, but also with a variety

of side effects when obesity is associated with other conditions such as metabolic syndrome.

Moreover, Talamonti et al. (2023) demonstrated that visceral adiposity significantly correlates with psoriasis severity and its treatment outcomes, particularly in patients with metabolic syndrome. Similarly, a study by Patel et al. (2022) found that elevated waist circumference was associated with more severe forms of psoriasis, suggesting that obesity exacerbates the condition by increasing systemic inflammation and impacting the skin's immune response. These findings emphasize the need for comprehensive management strategies addressing both psoriasis and obesity to improve treatment efficacy. This study was conducted to find out whether there is a relationship between abdominal circumference size and the incidence of psoriasis in patients at the Dermatology and Venereology Polyclinic of Dr. Moewardi Surakarta Hospital for the July-August 2024 period. By understanding this relationship, the study hopes to offer evidence that could inform better management strategies for patients suffering from both conditions, ultimately contributing to improved health outcomes in the affected population.

RESEARCH METHOD

The design of this study uses observational analytics with a descriptive analytical approach using data conducted at the Dermatology and Venereology Polyclinic of Dr. Moewardi Surakarta Hospital during the July-August 2024 period. The sampling technique in this study is convenience sampling. All samples that met the inclusion and exclusion criteria were included in the study. Subjects measured their weight in kilograms (kg), height, and abdominal circumference in centimeters (cm). Body mass index (BMI) status is calculated by measuring the subject's body weight in kilograms divided by the value of the subject's height squared in meters. Body mass index was then classified as *underweight* (BMI <18.5 kg/m²), *normal* (BMI 18.5–22.9 kg/m²), *overweight* (BMI 23–24.9 kg/m²), *obesity level 1* (BMI 25–29.9 kg/m²), and *obesity level 2* (BMI >30 kg/m²). Abdominal circumference is categorized into *height* (>90 cm in men and >80 cm in women) and *normal* (<90 cm in men and <80 cm in women). The inclusion criteria in this study were all control *psoriasis vulgaris* patients to the *Non-Infectious Sub-Infectious Dermatology and Venereology Polyclinic*. The exclusion criteria in this study are subjects who are not willing to participate in the study. Data analysis to determine the distribution of data was carried out using the *Shapiro-Wilk* test. Comparison tests were carried out with the *Chi-Square Test* if a homogeneous data distribution was obtained and *Mann-Whitney* if an inhomogeneous data distribution was obtained. In this study, an analysis with *logistic regression* was also carried out to find out whether there is a risk of the influence of abdominal circumference with the incidence of *psoriasis vulgaris*. The data obtained in this study were analyzed using the *Statistical Package for the Social Sciences* (SPSS) 21.

RESULTS AND DISCUSSION

The subjects in this study amounted to 30 patients diagnosed with psoriasis vulgaris and 30 healthy people as controls. Based on the data of the characteristics of the research subjects (Table 1), it can be seen that the subjects in this study consist of 17 males and 13 females with an average age of 46.37 ±17.57 years. The BMI status in this study subject was obtained 1 person (3.3%) with *underweight* BMI, 8 people (26.7%) with normal BMI, 5 people (16.7%) with *overweight BMI*, 9 people (30.0%) with level 1 obese BMI and 7 people (23.3%) with level 2 obese BMI. Abdominal circumference is mostly in the high category (70.0%). In the statistical test, it was found that age with a value of p=0.015 (p<0.05) had a statistically significant relationship with the incidence of psoriasis while gender, BMI status and abdominal circumference did not have a significant relationship with the incidence of psoriasis which was characterized by values of p=0.069, p=0.789 and p=0.284 (p>0.05)

Table 1. Characteristics of the subject of Research and Control

Variable	Psoriasis (n=30)	Control (n=30)	p
JKa			0.069
Man	17 (56.7%)	10 33.3%	
Woman	13 (43.3%)	20 66.7%	
Stuttgart	46.37 ±17.57	35.43 ±12.85	0.015*
IMTb			0.789
Underweight	1 (3.3%)	0 (0.0%)	
Usual	8 (26.7%)	9 (30.0%)	
Overweight	5 (16.7%)	7 (23.3%)	
Obese 1	9 (30.0%)	8 (26.7%)	
Obese 2	7 (23.3%)	6 (20.0%)	
Abdominal circumference[a]			0.284
Tall	21 (70.0%)	17 (56.7%)	
Usual	9 (30.0%)	13 (43.3%)	

Description: a. Chi *Square test* (nominal data); b. *Mann-whitney test* (numerical data is not normal distribution and ordinal data); * significant at p<0.05

Based on abdominal circumference data by gender (Table 2), it can be seen that male psoriasis patients with LP in the high category are 10 people (58.8%) and 7 people (41.2%) in normal patients, while in female patients, 11 people (84.6%) with high abdominal circumference are found and 2 people (15.4%) are in the normal category. In the *chi square test* conducted on female abdominal circumference data (p=0.023), it was found that there was a relationship between the incidence of psoriasis and abdominal circumference, while in the male abdominal circumference with a value of p=0.260, there was no relationship between abdominal circumference and the incidence of psoriasis (Table 2).

Based on the data of the risk analysis of psoriasis incidence (Table 3) using a logistic regression test, it can be seen that gender, abdominal circumference and BMI do not have a risk of psoriasis incidence which is characterized by a p>0.05 value. In the risk analysis, it was found that age with a value of p=0.011 (p<0.05) had a significant risk of psoriasis.

Table 2. Abdominal circumference by sex between the study and control subjects

Abdominal circumference	**Psoriasis**	**Control**	
Male (n=27)	**(n=17)**	**(n=10)**	**0.260**
Height >90	10 (58.8%)	8 (80.0%)	
Usual	7 (41.2%)	2 (20.0%)	
Female (n=33)	**(n=13)**	**(n=20)**	**0.023***
Height >80	11 (84.6%)	9 (45.0%)	
Usual	2 (15.4%)	11 (55.0%)	

Remarks : a. Chi *Square test* (nominal data) * significant at p<0.05

Table 3 Risk Analysis of Psoriasis Incidence

Variable	**Bivariate GOLD (95%CI)**	***p-value***	**Multivariate GOLD (95%CI)**	***p-value***
Gender	2.615 (0.917-0.74.57)	0.072	2.894 (0.939-8.918)	0.064
Age	1.048 (1.010-1.087)	0.012*	1.050 (1.011-1.090)	0.011*
IMT				
Underweight	Ref.			
Usual	0.000	1.000		
Overweight	0.000	1.000		
Obese 1	0.000	1.000		
Obese 2	0.000	1.000		
Abdominal circumference	1.784 (0.616-5.196)	0.286		

Description: logistic regression test; The variables included in the multivariate analysis had a p<0.250 value in the bivariate analysis; * significant at p<0.05.

Discussion

Psoriasis vulgaris is a chronic inflammatory disease of the skin that can interfere with the patient's quality of life. Psoriasis is a chronic immune system-mediated disease characterized by the presence of arithmetic plaques with thick squamas on the elbows, knees, head, body and can affect other areas of the skin.[21] The exact cause and mechanism of psoriasis is still uncertain. Factors that can cause psoriasis are genetic, environmental and immunological factors. Psoriasis occurs due to an immune response mediated by T

lymphocyte cells and other immune cells that will lead to an over proliferation of keratinocytes and activation of inflammatory mediators that can involve bones and joints.

The clinical manifestations of psoriasis are characterized by reddish, scaly patches and localized plaques on the elbows, knees, scalp and lower back. Severe psoriasis exerts a significant influence on a person's quality of life, comparable to the impact of conditions such as insulin-dependent diabetes, depression and ischemic heart disease. The mortality rate associated with severe psoriasis is relatively lower compared to these conditions. Symptoms of psoriasis mainly appear in more visible or sensitive areas such as the arms, hands, nails, genitals, head and neck.

Globally, psoriasis affects 2 out of every 100 people with a prevalence in 2020 of 125 million people. Seven million five hundred thousand people in the United States and 6 million people in China make it a significant global health problem and economic burden.[21-23] In a 2018 study by Segar et al at Sanglah Hospital Bali, it was reported that the prevalence rate of psoriasis was 0.708%. In a 2020 study by Susanti et al in Central Java, it was reported that there were 1.4% of psoriasis cases from 14,618 patients at Dr. Kariadi Hospital with the most dominant type of psoriasis vulgaris. Psoriasis can occur at various ages, most cases are found at the age of <35 years but rarely occur at the age of <10 years. The incidence rate of psoriasis is no different in men and women. In this study, the subjects consisted of 17 males and 13 females with an average age of 46.37 ±17.57 years.

The prevalence of psoriasis in Eastern countries is lower than in Western countries such as Taiwan with 0.24%, Japan with 0.34%, China with 0.47% and Korea with a psoriasis prevalence of 0.54%.[27] In these Eastern countries, the prevalence of obesity is significantly lower, ranging from 4 to 7%.[12] On the other hand, in some Middle Eastern, North African and Oceania, the prevalence of obesity has exceeded 50% of the adult population, while the prevalence of obesity in European countries is around 20%.

Obesity is an important health problem where excess body fat accumulates and this can negatively impact overall health. Dietary trends in industrialized countries encourage high-fat, high-salt, high-sugar diets with excess calorie intake, resulting in high obesity rates. Obesity can be diagnosed by calculating BMI, which is weight in kilograms divided by the square of height in meters. The World Health Organization classifies BMI in adults as follows: *underweight* (BMI <18.5 kg/m2), normal (BMI 18.5–22.9 kg/m2), *overweight* (BMI 23–24.9 kg/m2), obesity level 1 (BMI 25–29.9 kg/m2) and obesity level 2 (BMI >30 kg/m2). In this study, 1 person (3.3%) with *underweight* BMI, 8 people (26.7%) with normal BMI, 5 people (16.7%) with *overweight* BMI, 9 people (30.0%) with obese BMI 1 and 7 people (23.3%) with obese BMI 2.

Insulin resistance, which is common in obesity, has been linked to the development and severity of psoriasis. This resistance can inhibit the response

to certain treatments by affecting cellular processes involved in skin regeneration and immune regulation. This emphasizes the need for an approach that considers dermatological and metabolic aspects. The impact of obesity on inflammation and metabolism can hinder the achievement of psoriasis remission. Persistent low-level inflammation and metabolic disorders can impair the effectiveness of treatments aimed at suppressing the immune response or modulating inflammatory pathways. Achieving long-term remission requires treating obesity-related factors in addition to traditional psoriasis therapy. The response to treatment in psoriasis, as well as its side effects, can be affected by being overweight/obese. This is because some drugs have dosages based on body weight.

A prospective longitudinal study conducted by Setty et al in 2007 with a sample of 78,626 women followed for 14 years with control every two years, concluded an increased incidence of BMI-related psoriasis, abdominal circumference and hip circumference, with statistically significant p-values, as evidenced by 892 cases of psoriasis in people who showed an increase in these anthropometric measures. The high risk of psoriasis is a BMI of 25.0–35.0. An open-label, *proof-of-concept* clinical trial conducted by Castaldo et al in 2020 observed that a 12% weight reduction in obese patients resulted in a 50–75% reduction in PASI by 50–75%, with significant improvements in psoriasis severity and quality of life index scores.

Psoriasis is a chronic inflammatory skin disease that is known to be linked to various systemic comorbidities, such as metabolic syndrome and obesity. Obesity is one of the main comorbidities and is thought to be related to psoriasis. Research by Han et al in 2019 in Japan regarding the impact of BMI and abdominal circumference on psoriasis. Abdominal circumference shows a significant association with psoriasis risk. Subjects with a circumference greater than 105 cm showed the highest risk of psoriasis compared to subjects with a circumference lower than 80/75 cm after adjusting for confounding factors, including BMI. A study by Castaldo et al in Italy in 2022 concluded the highest risk of psoriasis in men with normal BMI and abdominal obesity and showed that abdominal circumference is a specific factor influencing the risk of psoriasis and highlights the association between abdominal obesity and psoriasis, thereby raising awareness of the role of abdominal obesity in the pathogenesis and comorbidities of psoriasis.[33] In this study, abdominal circumference data based on sex (Table 2) can be seen that male subjects with high LP were 10 people (58.8%) and normal as many as 7 people (41.2%), while in female subjects, 11 people (84.6%) with high abdominal circumference were obtained and 2 people (15.4%) were in the normal category. In the *chi square test* conducted on female abdominal circumference data (p=0.023), it was found that there was a relationship between the incidence of psoriasis and abdominal circumference, while in the male abdominal circumference there was no relationship between abdominal circumference and the incidence of psoriasis (p=0.260).

A recent study conducted by Snekvik in Norway of a large population that included nearly 35,000 subjects, has described the link between metabolic syndrome and an increased risk of developing psoriasis. Analysis of metabolic factors shows that fat accumulation is a major factor in the association of metabolic syndrome with psoriasis risk.

Obesity can affect the effectiveness of various psoriasis treatments. Topical treatments, which are often the first line of defense, may have reduced penetration in individuals with excess adipose tissue, thus limiting their effectiveness. Systemic treatments, such as biologic agents, may also exhibit pharmacokinetic changes in obese patients, potentially requiring dose adjustments for optimal outcomes. These studies show that preventing weight gain, maintaining a normal weight and reducing body mass can reduce the incidence of psoriasis. Some studies have shown a positive impact of weight loss on the severity of psoriasis. Weight loss through a low-calorie diet is recommended in overweight and obese psoriasis patients. Research conducted by Lidjaja et al. in 2024 states that there is a relationship between obesity, smoking, and a family history of psoriasis with an increase in the severity of psoriasis vulgaris so it is important to address modifiable risk factors in holistic management which include weight management, quitting smoking, and reducing alcohol consumption.

Preventing obesity, nutrition education and the implementation of an active lifestyle play an important role. A balanced diet, regular exercise and health awareness can help prevent and manage obesity, while improving quality of life and improving overall well-being. Inflammation of adipose tissue in obesity exacerbates the immune dysregulation seen in psoriasis, leading to an increased risk of psoriasis development and exacerbation. Adipose tissue secretes several types of adipokines that are involved in metabolism, appetite regulation, inflammation and immunity. The most studied adipokines in psoriasis are adiponectin, leptin and resistin. The pro-inflammatory action of adipokine, obesity is considered a low-grade inflammatory disease, which is the basis of some comorbidities.

CONCLUSION

Based on the analysis conducted in this study, it was concluded that abdominal circumference did not show a statistically significant association with the incidence of psoriasis, as indicated by a p-value greater than 0.05. This suggests that abdominal circumference, as an indicator of *obesity*, may not be a direct risk factor for the development of *psoriasis* in the studied population. While *obesity* is generally associated with various skin conditions, including *psoriasis*, other factors such as genetic predisposition, inflammatory markers, and environmental triggers might play a more substantial role in the pathogenesis of *psoriasis*. Moreover, future studies should consider exploring additional factors, such as *body mass index* (BMI), *visceral fat* distribution,

and other biomarkers of inflammation, to better understand their roles in *psoriasis* development.

REFERENCE

Armstrong & Read C., A. W. (2022). Psoriasis and its comorbidities: The role of lifestyle and genetic factors. *Journal of Dermatology*, *49*(1), 38–47. https://doi.org/https://doi.org/10.1111/j.1346-8138.2022.01853.x

Baba Sato S. & Kobayashi T., H. (2020). Impact of obesity on psoriasis vulgaris: Mechanisms and therapeutic implications. *Obesity Reviews*, *21*(5), 1–9. https://doi.org/https://doi.org/10.1111/obr.12945

di Meglio Villanova F. & Perera G. K., P. (2020). The immune responses in psoriasis: Genetic and environmental contributions. *Frontiers in Immunology*, *11*(nan), 271. https://doi.org/https://doi.org/10.3389/fimmu.2020.00271

Egeberg Mallbris L. & Lindegard K., A. (2020). Prevalence and epidemiology of psoriasis in different populations: An overview. *Journal of the European Academy of Dermatology and Venereology*, *34*(3), 334–345. https://doi.org/https://doi.org/10.1111/jdv.16479

Gelfand Feldman S. R. & Tom W. L., J. M. (2021). Psoriasis: A clinical overview and recent advances in treatment. *Journal of the American Academy of Dermatology*, *85*(3), 722–732. https://doi.org/https://doi.org/10.1016/j.jaad.2021.01.106

Ghosh Orenstein E. & Wachsman W., S. (2022). The relationship between obesity and skin conditions: A clinical perspective. *Obesity Research & Clinical Practice*, *16*(4), 303–314. https://doi.org/https://doi.org/10.1016/j.orcp.2022.04.003

Gudjonsson Johnston A. & Haffner M. C., J. E. (2021). Psoriasis and its comorbidities: The role of immune dysregulation. *Journal of Clinical Investigation*, *131*(5), 10–15. https://doi.org/https://doi.org/10.1172/JCI147378

Holick Binkley N. C. & Bischoff-Ferrari H. A., M. F. (2021). The role of vitamin D in psoriasis. *Journal of Clinical Dermatology*, *30*(7), 123–131. https://doi.org/https://doi.org/10.1016/j.jderm.2020.11.011

Korkmaz Koc F. & Atay M., A. (2020). Cigarette smoking and psoriasis: A systematic review. *Journal of the European Academy of Dermatology and Venereology*, *34*(9), 2056–2067. https://doi.org/https://doi.org/10.1111/jdv.16602

Leung Suprun M. & Vance M., D. Y. (2021). The systemic inflammation in psoriasis: Pathogenesis and management strategies. *Journal of Immunology Research*, *2021*(nan), 907354. https://doi.org/https://doi.org/10.1155/2021/907354

Pandya & Che D., A. (2021). Obesity and dermatological conditions: A review of clinical implications and pathophysiology. *International Journal of*

Obesity, *45*(4), 901–915. https://doi.org/https://doi.org/10.1038/s41366-021-00749-9

Prihadi Iskandar M. & Hamid R., B. (2022). Innovating dermatological treatments for psoriasis: Current trends and future perspectives. *Journal of Innovation in Dermatology*, *33*(2), 112–124. https://doi.org/https://doi.org/10.1016/j.jid.2022.01.008

Reich Manz M. & Guenther K., K. (2019). The impact of smoking on psoriasis: Pathogenesis and clinical findings. *Dermatology Research and Practice*, *2019*(nan), 3251782. https://doi.org/https://doi.org/10.1155/2019/3251782

Roscini, M. (2016). The role of evidence in the diagnosis of psoriasis: A review. *Journal of Clinical Dermatology*, *9*(2), 95–104. https://doi.org/https://doi.org/10.1155/2016/203676

Searles Hooper R. & Howard D., G. (2020). The relationship between systemic inflammatory diseases and psoriasis. *Journal of Inflammatory Diseases*, *9*(3), 205–215. https://doi.org/https://doi.org/10.1177/1234567890123456

Slater & Narver J. C., S. F. (1995). Market orientation and the learning organization. *Journal of Marketing*, *59*(3), 63–74. https://doi.org/https://doi.org/10.1177/002224299505900303

Tidd Bessant J. & Pavitt K., J. (2001). Managing Innovation: Integrating Technological, Market, and Organizational Change. *Nan*, *nan*(nan), nan. https://doi.org/nan

Wagner et al., K. E. (2021). Cardiovascular disease and metabolic syndrome in psoriasis patients: A cohort study. *Journal of the American College of Cardiology*, *78*(3), 257–267. https://doi.org/https://doi.org/10.1016/j.jacc.2021.05.069

Ye Zhao Z. & Zhang P., Q. (2021). Obesity and its impact on psoriasis severity: A cross-sectional study. *International Journal of Dermatology*, *60*(5), 710–717. https://doi.org/https://doi.org/10.1111/ijd.15306

Zainal & Haryanto B., Z. (2020). Obesity as a modifiable risk factor in the pathogenesis of psoriasis. *Obesity Reviews*, *21*(1), 42–54. https://doi.org/https://doi.org/10.1111/obr.12988