

BODY MASS INDEX AS A PROGNOSTIC BIOMARKER FOR ACNE VULGARIS: A SYSTEMATIC REVIEW ON PREVENTION AND THERAPEUTICS

¹ Ni Made Suari Asih, ² Ida Ayu Diah Purnama Sari, ³ Bayu Kresna Wiratama

¹ Faculty of Medicine Universitas Pendidikan Ganesha, Bali, Indonesia, suari@student.undiksha.ac.id

² Faculty of Medicine Universitas Pendidikan Ganesha, Bali, Indonesia, ida.ayu.diahsari@undiksha.ac.id

³ Faculty of Medicine Universitas Pendidikan Ganesha, Bali, Indonesia, bayukresnawiratama@gmail.com

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CORRESPONDENCE

Ni Made Suari Asih

Faculty of Medicine Universitas
Pendidikan Ganesha

E-mail: suari@student.undiksha.ac.id

ABSTRACT

Acne vulgaris is one of the most common dermatological conditions affecting more than 0.5 billion people worldwide. Several studies have shown that body mass index has a positive correlation with acne vulgaris. This systematic review aims to evaluate whether body mass index can serve as a prognostic biomarker for the severity of acne vulgaris due to prevention and therapeutics of acne vulgaris. A systematic search was conducted using Publish or Perish following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) until 27 February 2025 and a total 74 articles were analyzed. Studies included human participants aged 14–22 from Asia. Nine studies met the inclusion criteria, encompassing 1,563 participants (including acne cases and controls where applicable). Five studies demonstrated a statistically significant correlation between body mass index and acne severity. The remaining four showed inconsistent or non-significant associations, potentially due to differences in sample size, population characteristics, or control for confounding factors such as diet, hormonal status, and medication use. Most studies used standardized acne severity scales such as the Global Acne Grading System (GAGS). The findings indicate that high body mass index is generally associated with increased severity of acne vulgaris, supporting the potential body mass index could be a valuable addition to acne prevention and management strategies

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INTRODUCTION

Acne vulgaris represents one of the foremost dermatological issues, impacting upwards of 500

million individuals, and is classified as the eighth most common disease on a global scale¹. *The British Journal of Dermatology* revealed that the number of acne vulgaris cases in adolescents and young adults

increased by 39.2% globally from 1990 to 2021 in almost all countries with 1 in 5 people diagnosed with acne during this stage of life^{2,3}.

The condition implicates more than 85% of adolescents, with the disease frequently persisting into adulthood, particularly among females, accounting for two-thirds of consultations with dermatologists regarding acne⁵. Although acne doesn't directly endanger life, it often results in significant disfigurement and may lead to lasting scars, causing both physical and emotional distress^{6,7}.

Acne is characterized as a condition that affects the pilosebaceous unit, with key features comprising abnormal keratinocyte differentiation, increased sebum production by sebocytes, alterations in lipid composition, colonization by *Cutibacterium acnes*, and a pronounced inflammatory response⁸. Various factors have been reported to affect acne. For instance, progeny of parents with a history of acne demonstrate an increased probability of developing the condition¹². Furthermore, hormonal factors (particularly androgens), environmental influences, immune system dynamics, psychological stress, and dietary habits have all been implicated in the development of acne¹³. Body Mass Index (BMI) is the predominant metric to assess an individual's weight status¹⁴. Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults¹⁵. It is defined as a person's weight in kilograms divided by the square of their height in meters (kg/m^2)¹⁶. In individuals diagnosed with obesity, there frequently exists an elevation in androgen, insulin, insulin-like growth factor, and inflammatory markers, which can promote the proliferation and differentiation of sebaceous cells through the upregulation of adipogenic genes, thereby augmenting sebum production and affecting the severity of acne¹⁷.

Gündüz *et al.* (2023) demonstrated that moderate to severe acne had significantly greater BMI and BMI z-scores compared to those with mild acne ($p < 0.01$), they established a correlation between the severity of the condition and body mass index⁴. Conversely, Bunga *et al.* (2024) reported that no significant correlation existed between BMI and the prevalence of acne vulgaris. The highest prevalence of acne vulgaris was recorded among respondents categorized as underweight, with a rate of 6.7% ($p = 0.873$)¹⁸.

Previous studies have highlighted differences in the correlation between body mass index and the severity of acne vulgaris. To address the inconsistencies, the authors undertook systematic observations to assess the potential of body mass index as a prognostic biomarker for the severity of acne vulgaris. The authors aspire this review will enhance the understanding of the intricate relationship between body mass index and dermatological health, particularly concerning acne vulgaris, with the overarching aim of offering valuable insights for developing more effective strategies in the management and prevention of acne.

METHODS

This systematic review was conducted by following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines with the following research question: In adolescent and young adult populations, do differences in Body Mass Index (BMI) values between individuals with acne vulgaris and without acne correlate significantly with acne severity, so that BMI can be considered as a prognostic biomarker for acne prevention and treatment strategies in the era of global obesity?

The data was searched from published articles from Scopus, PMC, Semantic scholar, Google scholar databases through Publish or Perish and SINTA (Science and Technology Index) from inception until

27 February 2025. The keyword that we used were (acne OR "acne vulgaris") AND ("body mass index" OR BMI) AND (severity OR "acne severity") AND (adolescent* OR "young adult*").

This study used the population, intervention, comparison, and outcome (PICO) strategy to include studies that met the following criteria.

- Population: Individuals with acne vulgaris in different grades
- Intervention: Measurement and observation of body mass index in samples
- Comparison: Body mass index in acne vulgaris patients in different grades
- Results: Assess body mass index correlation and potential role as a biomarker for the development of acne prevention.

Eligibility criteria included the following: (1) human participants aged 12-59 years, (2) studies conducted in Asia, and (3) full studies in English or Bahasa Indonesia. Exclusion criteria were (1) human participants diagnosed with other than acne vulgaris, (2) animal studies, (3) studies that did not clearly delineate BMI levels by acne severity, (4) unrelated topics, and (5) studies that were systematic reviews, meta-analyses, case reports, theses, dissertations and were not original.

Three reviewers conducted independent screening from each search engine and decided whether the study should be included or excluded. The decision was visible to other reviewers (not blinded) and gathered altogether via Rayyan Systems Inc. Differences between decisions were discussed by all reviewers. The selected journals were assessed to extract the following information: author data, study title, study time and location, study design, inclusion and exclusion criteria, number of participants, variables analyzed (body mass index levels and acne severity), and results based on P value and correlation coefficient (r).

RESULTS

The flow diagram [Figure 1] shows that 261 studies reviewers searched from all databases. We manually excluded 81 duplicates and 106 ineligible by automation tools using Rayyan software.

The reviewers then screened the remaining 74 studies based on titles, abstracts, outcomes, and language. They excluded 23 studies for having unrelated themes, 8 for being the wrong publication type, and 18 for having bad outcomes. Reviewers did a full-text review of the remaining 21 studies and identified 9 that meet the inclusion criteria for this review. Nine studies met the inclusion criteria, comprising a total of approximately 1,563 participants (including acne cases and controls where applicable).

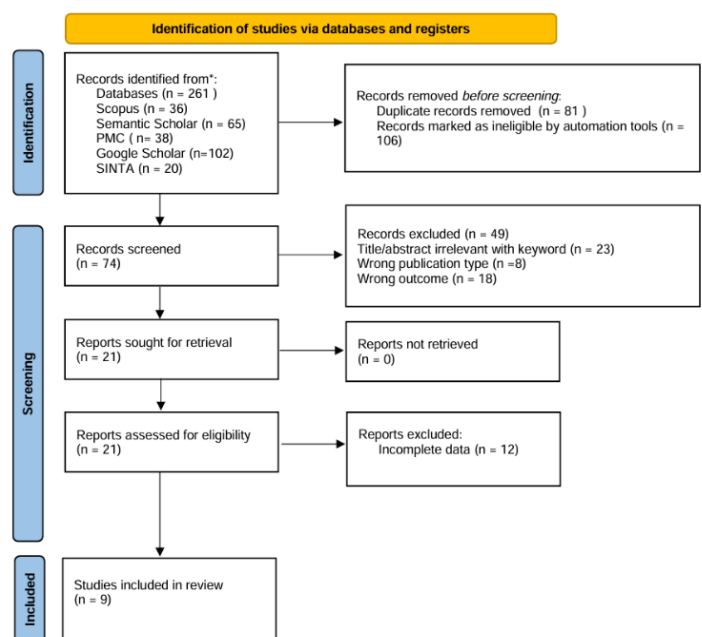


Figure 1. PRISMA flow figure

The sample sizes ranged from 72 to 384 participants. The studies were conducted in Turkey^{4,19}, Iraq²⁰, Indonesia¹⁸, Bangladesh²¹, Qatar²², India²³, Sudan²⁴, and Romania²⁵. [Table 1]. Regarding study design, one studies were prospective cohort studies⁴, one was a prospective case-control¹⁹, three were case-control studies^{20,23,24}, and four were cross-sectional

studies^{18,21,22,25} [Table 2]. Most studies included adolescents and young adults, with mean ages predominantly ranging between 14 and 22 years, although some studies did not explicitly report mean ages. Adjusted confounding variables commonly

included age, sex, exclusion of metabolic conditions such as polycystic ovarian syndrome (PCOS) and insulin resistance, medication use affecting metabolism or acne, dietary habits, and family history.

Table 1. Studies characteristic

Author,Year	Country	Study Design	Participants (mean age ± SD)	Adjusted Confounding Variables
Bahar Öztelcan Gündüz, 2023	Turkey	Prospective cohort	Case: 72 (14.7 ± 1.8), no control group	Age, sex, BMI z-score
Nazik H. Hasrat, 2023	Iraq	Case-control	Case: 201 (Not reported) Control: 203 (Not reported)	Age, sex, medication use, hormonal disorders
Yehekiel Holoaino Bunga, 2024	Indonesia	Cross-sectional	89 (mean age not reported)	Dietary intake, BMI
Md. Abul Kalam Azad, 2022	Bangladesh	Cross-sectional	125 (20.8 ± 5.9), no control group	Age, sex
Funda Tamer, 2024	Turkey	Case-control	Case: 160 (22 ± 3), Control: 160 (22 ± 3)	Age, sex, medical history
Yasir Aljoudi, 2023	Qatar	Cross-sectional	Case: 300 (20.88) Control : Not reported	Excluded meds affecting acne, considered family history acne
Barnita Saha, 2023	India	Case-control	Case: 100 (Not reported) Control: 100 (Not reported)	Medication, PCOS, diabetes, metabolic diseases
Moteb K. Alotaibi, 2025	Sudan	Cross-sectional	384 adolescents (Median 15.1, IQR 14.0–16.3)	Age, sex, parental education
Alexa Florina Bungau, 2024	Romania	Cross-sectional	152 acne patients (Mean age not reported)	BMI, insulin resistance, body composition, GPx activity

Several studies reported a significant association between body mass index (BMI) and the occurrence and severity of acne. Four studies found that BMI or BMI-related measures were significantly higher in acne cases compared to controls^{4,20,19,22} with most reporting p-values < 0.05. Two studies did not find a significant correlation between BMI and acne severity^{18,21}. One study demonstrated a positive correlation between increasing BMI z-score and acne severity assessed by the Global Acne Grading System (GAGS)⁴. Additionally, some studies highlighted the role of metabolic factors such as

insulin resistance, fasting glucose, and body fat percentage in exacerbating acne severity^{23,25}. Confounding variables adjusted for in several studies included age, sex, exclusion of metabolic conditions such as polycystic ovarian syndrome (PCOS) and insulin resistance, dietary habits, medication use, and family history of acne^{20,23,24}. Various acne severity assessment tools were employed across studies, predominantly GAGS^{4,19,22} and the Investigator Global Assessment Score²³

Table 2. Main outcome of the studies included in this systematic review of the correlation between body mass index and acne vulgaris

Author, Year	Mean BMI		P Value	Outcome - Result
	Case	Control		
Bahar Öztelcan Gündüz, 2023	22.9 ± 1.80	(No control group)	<0.01	Higher BMI z-score linked to increased acne severity in adolescents
Nazik H. Hasrat, 2023	(Not reported numerically)	(Not reported numerically)	0.001	Overweight/obesity more common in acne patients; BMI positively associated with acne occurrence and severity
Yehekiel Holoaino Bunga, 2024	(Not reported)	(No control group)	>0.05	No significant relationship between BMI and acne incidence
Md. Abul Kalam Azad, 2022	(Not reported)	(No control group)	0.129	No significant association between BMI categories and acne severity
Funda Tamer, 2024	(Mean not directly reported, higher than controls)	(Lower than cases)	<0.001	BMI, body fat percentage, and fat mass significantly higher in acne patients compared to controls
Yasir Aljoudi, 2023	21.1 – 21.4	(No control group)	NS (p>0.05)	No significant difference in BMI across acne severity grades
Barnita Saha, 2023	(Not reported numerically)	(Not reported numerically)	<0.05	BMI, fasting glucose, and insulin higher in acne patients
Moteb K. Alotaibi, 2025	Median ~18.4 (IQR 16.4–21.5)	Median not specified	Significant (exact p-value not specified)	BMI positively associated with acne prevalence in adolescents
Alexa Florina Bungau, 2024	(Not reported numerically)	(No control group)	Significant (p < 0.05)	BMI, insulin resistance, and fat mass correlated with acne severity

DISCUSSION

This systematic review aimed to assess the relationship between body mass index (BMI) and acne vulgaris, focusing on whether elevated BMI serves as a significant factor in the occurrence and severity of acne. Across the nine included studies, a range of methodologies,

populations, and confounding variables were accounted for, providing a comprehensive overview of current evidence.

Several studies reported significantly higher BMI values among acne patients compared to healthy controls^{4,20,19,22}. For example, Gündüz et al.⁴ found that adolescents with

moderate to severe acne had significantly greater BMI and BMI z-scores compared to those with mild acne ($p < 0.01$). Similarly, Hasrat et al.²⁰ observed a higher prevalence of overweight and obesity in acne patients relative to controls (26.86% vs. 15.76%), and a strong positive correlation between BMI and acne severity ($p = 0.001$). Tamer et al.¹⁹ confirmed these findings using body composition analysis, reporting significantly elevated BMI, body fat percentage, and fat mass in acne patients compared to controls ($p < 0.001$). Saha et al.²³ further supported this by showing higher fasting insulin and glucose levels in adolescent acne patients compared to controls ($p < 0.05$). These results align with the known pathophysiology linking adiposity to increased androgen production, insulin resistance, and inflammatory mediators that exacerbate acne. Conversely, some studies did not find statistically significant associations between BMI and acne severity. Azad et al.²¹ reported no significant difference in BMI categories across acne severity groups ($p = 0.129$), and Bunga et al.¹⁸ observed no significant relationship between BMI and acne incidence among medical students ($p > 0.05$). These discrepancies may be attributable to differences in sample size, population characteristics, or control for confounding factors such as diet, hormonal status, and medication use.

Metabolic parameters beyond BMI, such as insulin resistance and visceral fat, emerged as important modifiers in acne severity. Bungau et al.^{24,25} demonstrated that insulin resistance, higher fat mass, and visceral fat were significantly associated with severe acne ($p < 0.05$), suggesting that adiposity-related metabolic dysfunction contributes to acne pathogenesis independently of BMI alone.

Adjustments for confounding variables such as age, sex, diet, hormonal disorders (e.g., polycystic ovarian syndrome), and medication use were common across studies^{20,22,23} and essential for isolating the independent

effect of BMI on acne outcomes. Differences in acne severity assessment tools—primarily the Global Acne Grading System (GAGS)^{4,19,22} and the Investigator Global Assessment Score²³—may also contribute to heterogeneity in findings.

Taken together, the bulk of evidence suggests that increased BMI and associated metabolic disturbances play a substantial role in both the risk and severity of acne vulgaris. The inflammatory milieu associated with obesity, including hyperinsulinemia and increased androgen activity, likely promotes sebaceous gland hyperactivity and follicular hyperkeratinization, driving acne exacerbation. However, the presence of studies with null findings highlights the need for further well-powered, prospective research employing standardized BMI classifications and acne severity metrics, alongside comprehensive adjustment for lifestyle and hormonal factors. Doctors play a crucial role in educating patients about the relationship between body mass index (BMI) and acne. Through individualized counseling, doctors help patients understand how excess weight, hormonal imbalance, and systemic inflammation may contribute to acne severity. By promoting healthy lifestyle habits such as balanced nutrition, regular physical activity, and evidence-based skin care, doctors support early prevention and better clinical outcomes. Effective BMI education empowers patients to take an active role in managing their acne and encourages long-term adherence to treatment.

CONCLUSION

This systematic review indicates that increased body mass index (BMI) is generally associated with a higher risk and greater severity of acne vulgaris. Five studies demonstrated significant positive correlations between elevated BMI or related metabolic factors and acne outcomes, while four studies found no clear association, highlighting ongoing controversy. Metabolic dysfunctions such as insulin resistance may play a pivotal

role in exacerbating acne beyond BMI alone. Due to heterogeneity in study designs and confounder adjustments, further large-scale, prospective research with standardized measures is needed to clarify the role of BMI in acne pathogenesis and to guide targeted prevention and treatment strategies. Body Mass Index (BMI) serves as a simple, widely used diagnostic indicator to classify individuals based on their body fat status. Although BMI does not directly measure body fat, it provides a practical screening tool to identify individuals who may be underweight, overweight, or obese, conditions that are often associated with various metabolic and dermatological disorders, including acne. BMI use to support early detection of potential health risks and to guide further clinical evaluation. In acne research, BMI can help determine whether excess body weight contributes to inflammation, hormonal imbalance, or increased sebum production. While BMI alone cannot establish a definitive diagnosis of disease, it plays an important role as an initial, objective parameter that aids physicians in assessing patient risk profiles and planning appropriate interventions.

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