A New Insight Into The Relationship Between Obesity And Acne Vulgaris: A Cross-Sectional Study

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ABSTRACT

Background: Acne vulgaris is a prevalent skin condition among adolescents and young adults. A high body mass index is a risk factor for acne. People with a high body mass index (BMI) are more likely to have elevated levels of Insulin-like growth factor-1 and other factors that have been reported to be involved in the pathogenesis of acne.

Aim: To explore the possible relationship between BMI and the presence and severity of facial acne vulgaris.

Methods: A cross-sectional study included sixty patients diagnosed with acne vulgaris and 20 age- and sex-matched healthy volunteers. Body mass index (kg/m^2) was calculated for all study participants by measuring their height and weight. Japanese Acne Grading System was used to evaluate acne severity.

Results: The mean patients' age was 27.80 ± 4.48. Males represented (51.7%) of our patients. There was no statistically significant difference between the mean BMI of patients and controls (28.13 ± 4.64 kg/m^2, 28.31 ± 4.26 kg/m^2, respectively). Acne prevalence was 45% among patients with a BMI > 30 Kg/m^2, 23.3% in those with a BMI of 25-29.9 kg/m^2, and 31.7% in those with normal BMI. Patients with severe acne had significantly elevated BMI (29.19 ± 3.28) when compared to those with mild (25.31 ± 5.59) and moderate acne (26.97 ± 4.82) ($p< 0.001$).

Conclusion: Acne vulgaris is more prevalent among patients with higher BMI values. Acne severity and obesity are interrelated.

Keywords: Acne vulgaris, Body Mass Index: BMI, Obesity.

Introduction

Acne vulgaris (AV) is a chronic skin condition that affects the pilosebaceous unit, and it is identified by the appearance of both non-inflammatory and inflammatory lesions with or without scarring [1]**.** AV was found to affect 633 million people worldwide, making it the eighth most prevalent disease globally. AV was estimated to affect 80–90% of adolescents [2]**.**

Acne has a complicated multifactorial pathogenesis. Increased sebum production (influenced by androgens), comedo formation due to excessive keratin deposition, bacterial colonization of the follicle by Propionibacterium (Cutibacterium) acnes, and a local inflammatory response in the skin are the four main etiopathogenic processes of AV [3]. Emerging etiopathogenic factors, such as microbiota, antimicrobial peptides, and insulin resistance, have also gained researchers' attention [4]**.**

Acne can have profound systemic implications and co-morbidities. Metabolic syndrome (MetS) is one of the most important acne co-morbidities. It has been hypothesized that the prevalence of AV may be influenced by several factors, including obesity [5].

Obesity is commonly accompanied by peripheral hyperandrogenism, which has been linked to increased sebum production and the onset of acne. Furthermore, AV and obesity are frequently observed in Polycystic Ovary Syndrome (PCOS) [4]. Also, the release of adipokine-driven inflammatory cytokines among obese patients is a hypothesized culprit in the potential relationship between obesity and acne [6].

An ever-increasing number of people are becoming curious about the connection between these two disorders as a result of the alarming global rise in obesity prevalence among adolescents [7]. However, some studies evaluating the risk of acne in overweight or obese individuals have yielded contradictory results. In some studies, being overweight or obese was associated with an elevated incidence of acne among children and adults, while in others, it was linked to a protective effect against acne [8].

In addition to its effect on body mass, AV has a negative impact on patients' psychological state and quality of life (QoL), as it mostly affects the face [9].

The study aimed to investigate the possible relationship between body mass index (BMI) and acne and explore the possible relationship between acne severity and obesity.

Patients And Methods

This cross-sectional study was conducted on 60 Egyptian acne patients and 20 age- and sex-matched, apparently healthy controls. All study participants were enrolled from those attending the Dermatology Outpatients' Clinic, , Assiut University, between October 2019 and June 2021.

The effect size (0.538) was the basis for the sample size calculation according to a previous trial [10]. The total minimum required sample size was calculated to be 47. So, the final sample size was raised to 60 patients and 20 controls. We calculated the sample size using the G Power program (V. 3.1.9.6, Düsseldorf, Germany).

Inclusion Criteria:

Patients with AV of any clinical type, of both genders and age range between 18 and 35 years, were enrolled in our study.

Exclusion Criteria:

Patients below 18 and above 35 years.

Patients with any concomitant Dermatologic or systemic illness.

Patients who used any topical acne medication one month before enrollment.

Patients who used any systemic acne medication three months before enrollment.

All study participants (cases and controls) underwent detailed history-taking regarding sociodemographic and clinical data. Meticulous general and dermatologic examinations were performed.

To calculate BMI, height and weight were measured, and it was calculated according to the following formula:

BMI = Weight (kg)/Height (m^2).

The patient's weight was categorized as listed in **(Table 1)** [11].

Table 1. Adult Body Mass Index Classification.

Category	***BMI (kg/m2) from to***
Underweight	<18.5
Normal	18.5 to 25
Overweight	25 to 30
Obese class 1	30 to 35
Obese class 2	35 to 40
Obese class 3	40 to 45

Local (Dermatological) Examination:

All patients underwent local (dermatological) examination to exclude any associated dermatologic illness and determine acne severity. Acne severity was evaluated by the Japanese Acne Grading System, based on counting inflammatory lesions across half of the face **(Table 2)**[12].

Table 2. Japanese Acne Grading System**.**

Category	***Inflammatory lesions number***
Mild	≤ 5
Moderate	6-20
Severe	21-50
Very severe	>50

***Ethical Considerations**:*

The Ethical Committee of the Faculty of Medicine, , Assiut University approved the study in April 2019 (IRB No:17100718). After adequately explaining the research goal, informed consent was obtained from all study participants.

Statistical Analysis

Data was collected and analyzed using the Statistical Package for the Social Sciences (SPSS, version 20, IBM, Armonk, New York, USA). The data were represented as mean ± standard deviation (SD) for quantitative and qualitative variables as numbers and percentages. Student t-test for parametric variables compared two groups, while ANOVA was utilized for more than two groups. The Chi-square test ($\chi 2$) was used for comparing qualitative data. *p*-value was deemed significant if < 0.05.

Results

Demographic data

The mean ± SD of patients' age was 27.80 ± 4.48. Nearly half the patients (51.7%) were males. In addition, 68.3% of our patients came from rural areas. Regarding occupation, most patients (33.3%) were workers **(Table 3).** Patients and controls were comparable in terms of age (*p*=0.21), gender (*p*= 1.00), residence (*p*= 0.78), and occupation (*p*= 0.8). Regarding patients' skin phototypes, it was found that 13 (21.7%), 36 (60%), and 11 (18.3%) patients had skin phototypes III, IV, and V, respectively.

Table 3. Demographic Data of Patients and Controls.

	Patients (n= 60)	***Controls (n= 20)***	***P* value***
***Age* (years):**	27.80 ± 4.48	26.40 ± 4.79	0.21
Sex:			1.00
Male	31 (51.7%)	11 (55%)	
Female	29 (48.3%)	9 (45%)	
Residence:			0.78
Rural	41 (68.3%)	13 (65%)	
Urban	19 (31.7%)	7 (35%)	
Occupation:			0.80
None	17 (28.3%)	7 (35%)	
Worker	20 (33.3%)	6 (30%)	
Employee	6 (10%)	3 (15%)	
Student	17 (28.3%)	4 (20%)	

Data represented as a number (%), mean ± SD. P-value was significant if < 0.05.
*Sex was compared using the Chi-square test, while the student's t-test compared age.

Body Mass Index of Patients and Controls

When we compared the mean BMI (kg/m^2) of patients (28.13 ± 4.64) with that of the controls (28.31 ± 4.26), we could not detect any significant difference (p= 0.88). Similar insignificant differences between patients and controls were noted regarding the class of BMI (p=0.66). Interestingly, we noticed that the majority of our patients (45%) were obese, and 14 patients (23.3%) were overweight, while the rest (31.7%) were of normal weight **(Table 4) (Figure 1-2).**

Table 4. Body Mass Index of Cases and Controls.

	Patients (n= 60)	***Controls (n= 20)***	***P value****
BMI (kg/m^2)	28.13 ± 4.64	28.31 ± 4.26	0.88
Class of BMI			
Normal	19 (31.7%)	6 (30%)	0.66
Overweight	14 (23.3%)	3 (15%)	
Obese	27 (45%)	11 (55%)	

expressed as frequency (percentage), mean ± SD. *P* value was significant if < 0.05.

*The class of BMI was compared using the Chi-square test, while the student's t-test was used to compare the BMI.

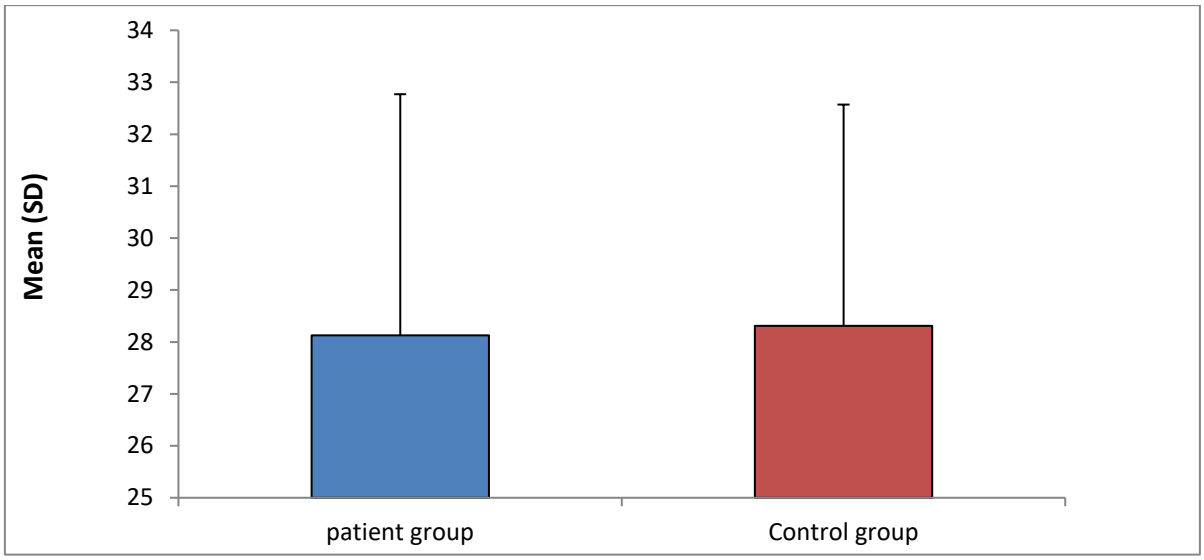

Figure 1. Body mass index of patients and controls.

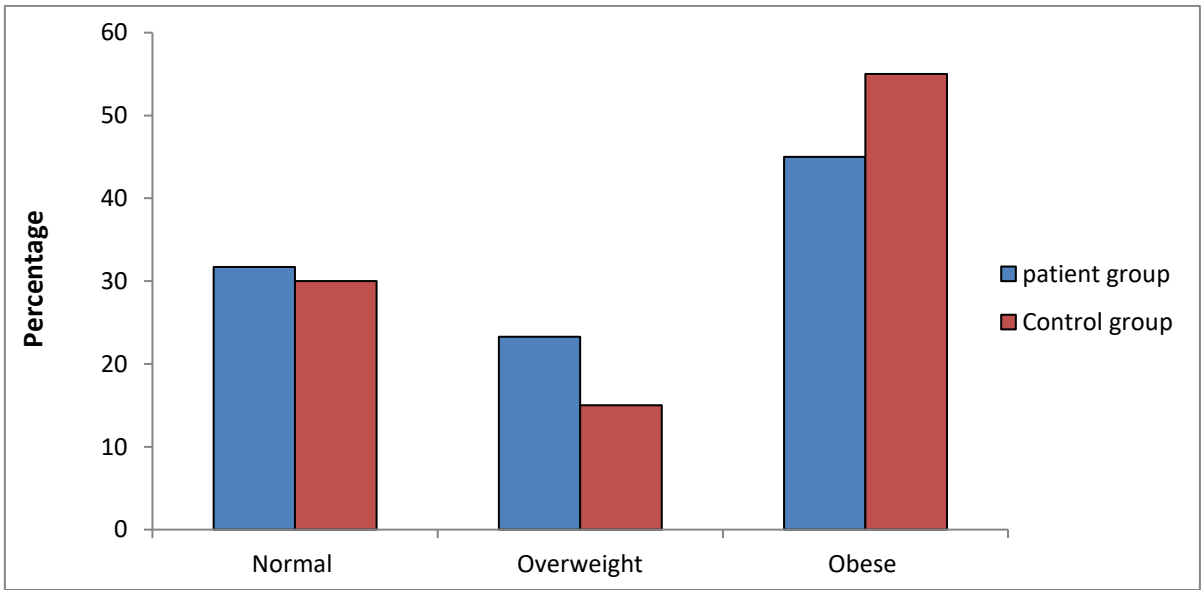

Figure 2. Class of body mass index in patients and controls.

Acne Grading in Relation to BMI

We noted that patients with severe acne had significantly elevated BMI (29.19 ± 3.28) when compared to those with mild (25.31 ± 5.59) and moderate grades (26.97 ± 4.82), ($p< 0.001$) **(Table 5) (Figure 3).**

Table 5. BMI Effect on Acne Grade.

Grading of acne	Mean ± SD
Mild	25.31 ± 5.59
Moderate	26.97 ± 4.82
Severe	29.19 ± 3.28
P value*	< 0.001

Data represented as mean ±SD. p-value was significant if <0.05; *Data was compared by ANOVA test.

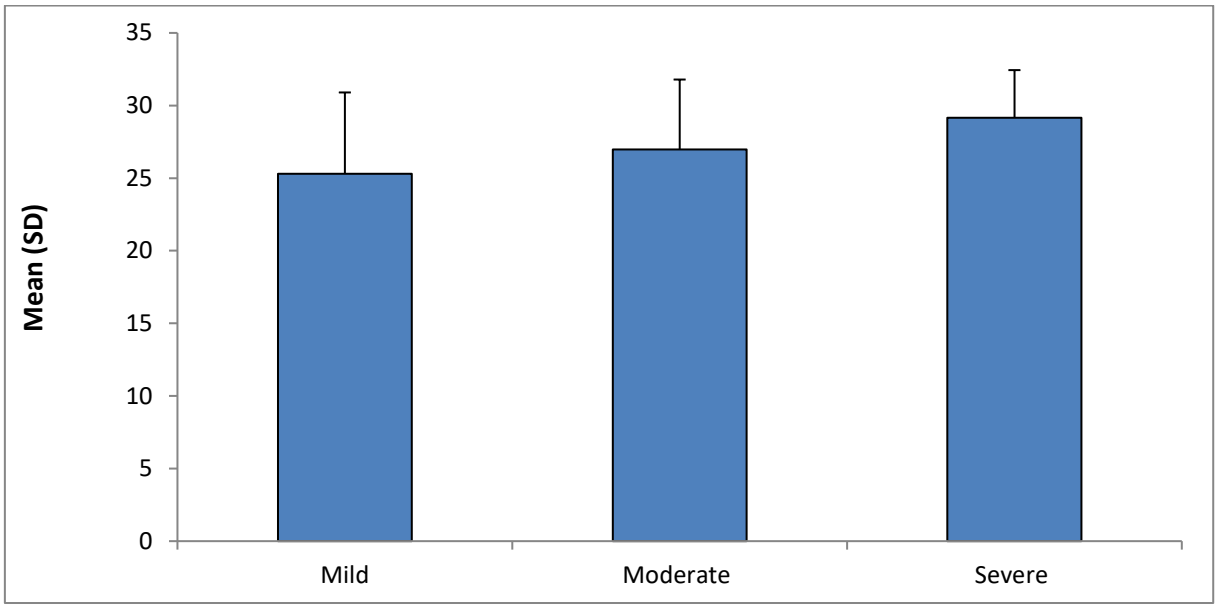

Figure 3. Effect of BMI on acne grade.

Discussion

Acne is the most common skin disease of adolescents and young adults. It is a complex multifactorial disorder that distresses many patients because of its chronicity and cosmetic concerns [13, 14]**.**

A growing number of people around the world are overweight or obese [15]. Obesity is related to a variety of metabolic disorders, including diabetes mellitus (DM), metabolic syndrome, PCOS, and others [16, 17]. BMI is a statistical tool regularly used to measure overweight and obesity. A relationship between BMI and acne has been proposed for a long time, and relevant research has increased in recent years but with disputed results [8].

According to some studies, having a BMI of more than 25kg /m^2 is a significant risk factor for AV [8]. Nevertheless, other researchers have found no association between BMI and AV.

This study was designed to investigate the possible interrelation between AV and obesity. Also, exploring the correlation between Acne severity and obesity was another important target.

In this study, the mean BMI of our patients was 28.13, with no significant difference from that of the control group (28.31), denoting a tendency for overweight in both groups. This can be explained by the fact that the mean BMI of our study participants was comparable to the mean BMI of the Egyptian population (28.2), which was reported in the WHO report in 2017 [18] and in the study conducted by El-Komy et al., [19] (28 ±7.3). So, it is logical not to find such a significant difference because of the tendency of the Egyptian population, in general, to be obese.

Like our findings, Podder et al. [9] did not observe any statistically significant difference in the BMI between acne patients and controls.

The present study found that patients with severe acne grades have significantly higher BMI values than those with mild and moderate grades. In concordance with our findings, previous research has reported that acne severity was related to obesity[20, 21]. Sas and Reich [22]observed that the BMI value correlated significantly with the severity of acne. Also, it has been described that AV deteriorates associated with increased BMI [8].

On the other hand, Duquia et al. [23] reported that acne severity has no relation with BMI. They explained that BMI is not an accurate measurement of body composition since it does not accurately distinguish body fat from lean mass. Also, Anaba et al. [24] found that acne severity is unrelated to BMI.

Interestingly, some researchers have noted that obesity protects against acne. They attributed this finding to the increased aromatase activity in obese individuals, augmenting the peripheral conversion of androgens to estrogens within adipose tissue. Estrogens, in turn, oppose the action of androgens and decrease sebum production. Moreover, obesity may suppress the activity of 5-alpha-reductase II, which is responsible for converting testosterone to the more active DHT, an important mediator of acne pathogenesis [20].

Although the mechanism by which obesity influences acne is not well understood, it seems that increased fat content in overweight/obese patients may facilitate free radical production and lipid peroxidation [25], which may be an early etiopathogenic event of acne. Also, elevated insulin-like growth factor-1 (IGF-1) levels among overweight patients can stimulate keratinocyte proliferation, sebaceous lipogenesis, and androgen synthesis, well-known players in acne development [22].

Additionally, Melnic et al. [26] mentioned that AV appears to be an indicator disease of the over-activated mechanistic target of rapamycin complex 1 (mTORC1) signaling with an unfavorable metabolic deviation to serious Western diseases of civilization, such as increased BMI and insulin resistance. The elevated levels of mTORC1 signaling caused by a Western diet may explain the correlation between AV, elevated BMI, and insulin resistance.

The relationship between AV and obesity is likely bidirectional. As chronic inflammation is the cornerstone event in AV, long-term metabolic modification, which is the increased risk of MetS, seems probable. MetS is a cluster of metabolic derangements, including insulin resistance, hypertension, dyslipidemia, and central obesity. Numerous authors have emphasized the correlation between this syndrome and AV [27-29]. Although the pathogenesis underlying such association is still to be elucidated, many pro-inflammatory cytokines, prothrombotic factors, elevated homocysteine, leptin and resistin, decreased serum adiponectin, and the presence of nonalcoholic fatty liver have been proposed as possible links [30].

Also, it can be hypothesized that patients with severe acne are more likely to become overweight due to factors such as social isolation, bad eating habits, depression, and a lack of motivation to engage in physical activities. On the other hand, adipose tissue is a well-recognized endocrine organ that secretes soluble substances with inflammatory and immunological implications. So, developing adipose tissue and the subsequent release of pro-inflammatory mediators may contribute to and exacerbate acne in overweight/obese patients [31].

Conclusions

This study concluded that there is a strong relation between acne severity and obesity, as shown by the fact that the vast majority of acne patients, especially those with severe grades, were overweight or obese. Therefore, these findings potentially recommend the importance of future studies to evaluate the role of dietary and nutritional adjustments in acne management guidelines. To gain a deeper understanding of the pathophysiology of AV, this study's findings can potentially serve as a guide for future research on obesity and other risk factors.

The limitation of this study is the relatively small sample size of the study population.

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