

RESEARCH PAPER

The relationship between body mass index and acne vulgaris - a comparative study

Nazik H. Hasrat,¹ Asaad Q. Al-Yassen ²

1. Community Medicine Specialist, Scientific Research and Development Unit, Division of Specialised Centers, Basrah Health Directorate, Basrah, Iraq.
2. Professor of Dermato-epidemiology, Department of Family and Community Medicine, College of Medicine, University of Basrah, Basrah, Iraq.

Received: 2023-06-15 Accepted: 2023-06-22

Abstract

Background: Acne vulgaris is a chronic inflammatory disease of the pilosebaceous unit that usually affects adolescents. Multiple factors have been implicated in the pathogenesis of acne vulgaris, and there is an increasing interest in studying the effect of obesity and body mass index (BMI) on the development of acne vulgaris.

Objectives: This study aims to assess the association between body mass index and the occurrence of acne vulgaris in addition to the correlation between BMI and acne severity.

Methods: A case-control study was conducted in the dermatology outpatient clinic of Al-Fayhaa Teaching Hospital in Basrah city. Body mass index was measured for 201 acne vulgaris patients who were age- and gender-matched with 203 controls.

Results: the current study found that the percentage of overweight and obesity was higher among acne vulgaris patients (26.86% and 8.45%, respectively) than controls (15.76% and 1.48%, respectively), particularly among pre-adolescent females (P-value = 0.001). The higher BMI was significantly associated with severe acne, and there was a significant positive correlation between BMI and the global acne severity score ($r = 0.830$, P-value = 0.001).

Conclusion: Increasing BMI is associated with an increase in the occurrence and severity of acne vulgaris.

Key words: obesity, BMI, nutrition, acne, overweight.

Corresponding author: Nazik H. Hasrat, Community Medicine Specialist, Scientific Research and Development Unit, Division of Specialised Centers, Basrah Health Directorate, Basrah, Iraq.

✉ E-mail: Nazikbedoyan@gmail.com

Introduction

Acne vulgaris is a chronic, self-limiting inflammatory disorder of the pilosebaceous unit. *Cutibacterium acnes*, formerly known as *Propionibacterium acnes*, causes acne vulgaris in adolescence under androgenic

control.¹ Because chronic inflammation is an integral part of acne vulgaris regardless of severity, long-term metabolic changes are probable, raising the risk of metabolic syndrome. The metabolic syndrome, also known as syndrome X, is a symptom complex that raises the risk of type 2 diabetes, cardiovascular disease, obesity, and other morbidities. Psoriasis, androgenetic alopecia, acanthosis nigricans, skin tags, lichen planus, hidradenitis suppurativa, rosacea, systemic lupus erythematosus, and acne vulgaris are among the dermatological illnesses associated with this syndrome, according to

numerous experts.²⁻⁴ Although the actual mechanism between obesity and acne vulgaris is still uncertain, many pro-inflammatory cytokines, prothrombotic factors, elevated homocysteine, leptin, and resistin levels, decreased serum adiponectin, and the development of non-alcoholic fatty liver disease have all been linked.⁵ Furthermore, acne sufferers have higher mTORC1 (mechanistic target of rapamycin complex 1) signalling activity, which is similarly linked to peripheral insulin resistance, type 2 diabetes, and obesity, strengthening the link between acne, obesity, and metabolic syndrome.⁶ A high body mass index is one risk factor for acne development. Increased insulin-like growth factor-1, which has been linked to acne aetiology, is thought to be more common in children with a high body mass index, and those having a low BMI protect against acne vulgaris.^{7,8} There is an increasing interest in studying the effect of obesity and BMI on acne vulgaris, which obviously have become new threats to adolescents and young adults in recent years. This study aims to assess the association between body mass index (BMI) and acne vulgaris.

Method

A case-control study was conducted from January 1, 2022, to April 1, 2022, in the dermatology outpatient clinic of Al-Fayhaa Teaching Hospital in Basrah city. Two hundred and one patient who fulfilled the inclusion criteria were age- and sex-matched with 203 controls recruited from another outpatient clinic. The inclusion criteria for the study were: patients with acne vulgaris who were willing to participate in the study; while subjects on any medications known to affect metabolism including topical

steroids, previous treatment with oral retinoids or any hormonal treatment for any reason in the previous three months, cigarette smoking, a history of diabetes mellitus, hypertension, psoriasis, polycystic ovarian disease, women with menstrual irregularities, known hormonal dysregulations or any other known metabolic disorders were excluded from the study. All of the enrolled patients were subjected to a clinical examination. It involved measuring the height and weight of subjects. Then body mass index (BMI) was calculated for them. The researcher used a specific scoring system for the assessment of severity called the Global Acne Grading System (GAGS). According to this score, acne was graded as mild, moderate, severe, and very severe.⁹ The dataset was coded and analysed using the Statistical Package for the Social Sciences (SPSS) version 26. The numerical data was tabulated as mean and standard deviation (SD). The independent sample student t-test was used to compare the two groups, and ANOVA analysis was used to compare the means of more than three groups. The Fisher's Exact Test was used to analyze the qualitative data, which was tallied as a percentage. The Pearson correlation test was used to assess the strength and direction of association between the study variables. A P value of 0.05 or less is considered statistically significant. Ethical approval was granted from the Ministry of Higher Education, University of Basrah, College of Medicine, Research Ethics Committee (No. 8/39/331 dated on 23/1/2022) and the Ministry of Health and Environment, Basrah Health Directorate, Training, and human resources center - research unit (No. 910 dated on 13/12/2021). Written consent was obtained from the patients in both cases and controls to participate in the study.

Results

In this study, 201 cases and 203 controls were included. Female patients made up 145 (72.14%) of the cases and 144 (70.94%) of the controls, while male patients made up 56 (27.86%) of the cases and 59 (29.06%) of the controls. The mean \pm SD of age was 18.5 ± 3.7 years in cases and 18.9 ± 3.9 years in controls. There was no significant difference between the patient and control groups regarding sex or age ($P > 0.05$). According to the GAGS score, 57 (28.36%) had mild acne, 124 (61.69%) had moderate acne, and 20 (9.95%) had severe acne, (Table-1).

Table 1. The characteristics of the study participants (Table-2), displays the distribution of cases and

Sociodemographic characteristics		Case		Control		P value
		No.	%	No.	%	
Age	Mean \pm SD	18.5 \pm 3.7		18.9 \pm 3.9		0.401**
	≤ 15	48	23.88	44	21.67	0.208*
	16-20	107	53.23	101	49.75	
	21- 25	27	13.43	42	20.69	
	>25	19	9.46	16	7.89	
Sex	Male	56	27.86	59	29.06	0.826
	Female	145	72.14	144	70.94	
Severity of acne	Mild	57	28.36			
	Moderate	124	61.69			
	Severe	20	9.95			
Total		201	100.0	203	100.0	
** Independent-Samples T-Test * Chi-square test						

controls according to the body mass index. Although the majority of both study groups had normal weight, the percentage of overweight and

obesity was higher among acne vulgaris patients 26.86% and 8.45% than controls, in which overweight and obesity constituted 15.76% and 1.48%, respectively. There was significant difference between both groups with respect to the weight (P -value = 0.001).

Table 2. The distribution of cases and controls according to body mass index

BMI	Case		Control		P-value	
	Frequency	%	Frequency	%		
Mean \pm SD	23.17 \pm 4.37		22.14 \pm 2.39		0.003**	
BMI categories	Underweight	5	2.48	7	3.45	0.001*
	Normal	125	62.19	161	79.31	
	Overweight	54	26.87	32	15.76	
	Obese	17	8.46	3	1.48	
	Total	201	100.0	203	100.0	
BMI: Body mass index, SD: Standard deviation ** Independent-Samples T Test, * Fisher's Exact Test						

There is a significant association between the BMI value and acne vulgaris among those patients younger than 20 years; hence, a higher BMI is noticed among cases than controls (P -value = 0.001). Among those with acne above the age of 20 years, no significant association is detected (Table-3).

Table 3. The association between age of participants and BMI

BMI	Age < 20		P-value	Age \geq 20		P-value
	Case	Control		Case	Control	
Mean \pm SD	22.9 \pm 4.31	21.31 \pm 2.15	0.001	23.96 \pm 4.63	23.38 \pm 2.2	0.334
Total	135	122		66	81	
BMI: Body mass index, SD: Standard deviation * Independent-Samples T Test						

(Table-4), shows that there is a significant association between BMI and female sex as a higher BMI is detected among female patients with acne if compared with controls (P-value = 0.001).

Table 4. The association between sex of participants and BMI

BMI	Male		P-value	Female		P-value
	Case	Control		Case	Control	
Mean ± SD	23.19 ± 4.27	23.36 ± 2.31	0.790	23.16 ± 4.42	21.64 ± 2.24	0.001
Total	56	59		145	144	

BMI: Body mass index, SD: Standard deviation
* Independent-Samples T Test

The association between the severity of acne and BMI is shown in (Table-5). The higher BMI is significantly seen among those with severe acne (P-value = 0.001).

Table 5. The association between acne severity and BMI

BMI	Mild	Moderate	Severe	P-value *
Mean ± SD	21.83 ± 3.45	22.6 ± 3.87	30.54 ± 2.1	0.001
Total	57	124	20	

SD: Standard deviation
* ANOVA analysis with post-hoc Bonferroni correction

A significant positive correlation was noticed between the BMI and acne severity score (GAGS) ($r = 0.830$, P-value = 0.001). The correlation is illustrated in Figure (1).

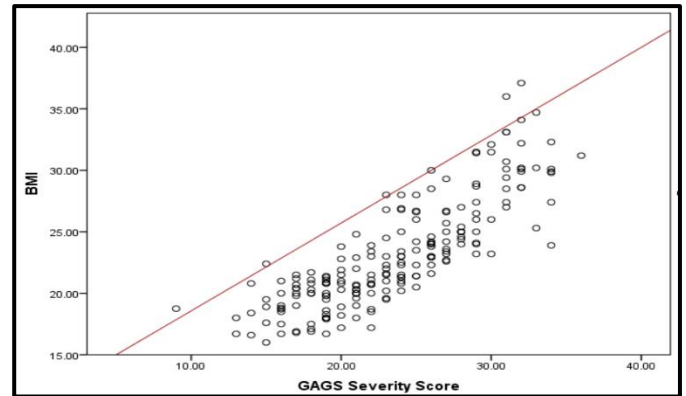


Fig 1. The correlation between BMI and GAGS severity score

Discussion

There is increasing evidence about the relationship between acne vulgaris and obesity; hence, some studies related to acne risk factors in young adults and adolescents found an impact of a high body mass index (BMI) on acne development. These studies reported that a low BMI protects against acne vulgaris.^{7,8} Those findings agree with the present study results, as a significant association is found between BMI and acne development. However, these findings are inconsistent with those of Snast et al., who claimed that the proportion of participants with acne decreased gradually from the underweight to the severely obese group.¹⁰ Actually, the relation between acne and obesity can be explained based on the evidence of high levels of androgens, insulin, growth hormone, and insulin like growth factors, which are well known risk factors for acne.¹¹ On the other hand, the mean BMI in the present study population fell within the normal range and was compatible with the BMI in studies conducted by Ekiz et al. in Turkey,¹² Di Landro et al. in Italy,¹³ Richter et al. in Germany,¹⁴ and Anaba et al. in Nigeria.¹⁵ The association between age and BMI among acne patients is also variable between studies; this

study found that a higher BMI was significantly associated with acne development among those younger than 20 years but not for those older than 20 years. This finding is similar to the findings of Halvorsen et al., which found that acne and BMI are associated among adolescents and not adults,¹⁶ and it is also in keeping with the findings of Anaba et al.,⁷ Ekiz et al.¹² and Di Landro et al.,¹³ The association between gender and the development of acne is also complex, and the results of the studies are controversial. In adult women, BMI seems to have a variable impact on acne.^{12, 13, 17} According to studies conducted in Turkey and Italy, the BMI of adult women with acne is unrelated to the prevalence and severity of acne.^{12, 13} Furthermore, Anaba et al. claimed that there is no variation in BMI between controls and patients with adult female acne and they reported that BMI is not a risk factor for female acne.¹⁵ This disagrees with the finding of this study, as it detected a significant association between BMI level and female acne. But this research findings are in line with a study by Halvorsen et al., who demonstrated that overweight and obesity are associated with acne in girls, but the same association was not observed in boys.¹⁶ On the other hand, and according to a little bit an old study from Taiwan done by Tsai et al., it has been shown that both boys and girls in Taiwan with lower BMI have a lower prevalence of acne with no significant difference between the two genders.¹⁸ Regarding the relation between the severity of acne and BMI, most of the studies agreed that the severity of acne increases with the increment of BMI, and this is completely in line with the findings of this study, which found a significant association and a strongly positive correlation between BMI and severity of acne. Lu and Hsu in Taiwan discovered that BMI was positively related to

acne severity.¹⁷ A recent study by Sas et al. showed that teenagers who have been overweight or obese had inflammatory acne (papulo-pustular or nodulo-cystic) more often than those who were underweight, thin, or of normal weight. They also discovered that individuals with comedonic acne had a considerably lower mean BMI than those with papulo-pustular or nodulo-cystic acne. Furthermore, the BMI value was found to be significantly related to the severity of acne and the number of skin areas affected by acne.¹⁹ On the other hand, according to Anaba et al., there was no association between acne severity and BMI.⁷ In their study of acne, Ekiz et al. in Turkey were unable to establish a relation between BMI and acne severity.¹² The current findings are also in line with two other studies done in Basrah that evaluated the metabolic aspects of acne vulgaris. One of them found that all parameters of the lipid profile are affected among acne patients, notably females, those younger than the age of puberty, and those with severe grades, especially for the high LDL and triglyceride levels, and this is also reflecting a positive association between lipids and acne vulgaris.²⁰ The other study found that the majority of acne patients documented to have insulin resistance based on C-peptide and TyG index levels, as well as the mean of these two biomarkers, are significantly higher in acne cases compared to control candidates, in addition to the positive and strong correlation between the level of these biomarkers and the severity of acne.²¹ and again, this is another reflection of the relationship between overweight, obesity, and acne vulgaris through the process of insulin resistance. The present results definitely demonstrate the link between BMI and acne. This relationship has a big impact on how acne patients are treated because effective treatment for acne patients should not only concentrate on

selecting the right medications but also consider changing the patient's dietary behaviours, increasing their physical fitness, and, if required, losing weight.

Conclusions and recommendations, we conclude that the body mass index of acne patients is significantly higher among acne cases than controls, especially in those younger than twenty and females, and it is significantly and positively correlated with acne severity. We recommend encouraging patients to have healthy lifestyle and to adjust dietary risk factors and encouraging exercise and weight reduction.

Conflicts of Interest

The authors declare they do not have any conflicts of interest.

Funding

The authors did not receive any funding from any institution or company, and this research is fully funded by the researchers themselves with the use of Basrah Health Directorate and Al-Fayhaa Teaching Hospital facilities.

Acknowledgments

We would like to acknowledge the help of all dermatologist and nursing staff who helped us accomplish this work, and we would like to express our deep thanks and gratitude to all candidates for their voluntary participation in this study.

References

1. Yan HM, Zhao HJ, Guo DY, Zhu PQ, Zhang CL, Jiang W. Gut microbiota alterations in moderate to severe acne vulgaris patients. *J Dermatol.* 2018; 45(10):1166-1171.
2. Nagpal M, De D, Handa S, Pal A, Sachdeva N. Insulin Resistance and Metabolic Syndrome in Young Men with Acne. *JAMA Dermatol.* 2016; 152(4): 399-404.
3. Agarwal K, Das S. Metabolic syndrome- The underbelly of dermatology. *Gulf J Dermatol Venerol.* 2019; 26(2).
4. Biagi LG, Sañudo A, Bagatin E. Severe Acne and Metabolic Syndrome: A Possible Correlation. *Dermatology.* 2019; 235(6): 456-462.
5. Stefanadi EC, Dimitrakakis G, Antoniou CK, Challoumas D, Punjabi N, Dimitrakaki IA, et al., Metabolic syndrome and the skin: a more than superficial association. Reviewing the association between skin diseases and metabolic syndrome and a clinical decision algorithm for high-risk patients. *Diabetol Metab Syndr.* 2018; 10: 9.
6. Melnik BC. Acne vulgaris: The metabolic syndrome of the pilosebaceous follicle. *Clin Dermatol.* 2018; 36(1): 29-40.
7. Anaba LE, Ogunbiyi OA, George OA. Adolescent Facial Acne Vulgaris and Body Mass Index: Any Relationship? *West African Journal of Medicine.* 2019; 36(2):129-132.
8. Okoro EO, Ogunbiyi AO, George AO, Subulade MO. Association of diet with acne vulgaris among adolescents in Ibadan, southwest Nigeria. *Int J Dermatol.* 2016; 55(9): 982-988.
9. Alsulaimani H, Kokandi A, Khawandanh S, Hamad R: Severity of acne vulgaris: comparison of two assessment methods. *Clin Cosmet Investig Dermatol.* 2020; 13: 711-716.
10. Snast I, Dalal A, Twig G, Astman N, Kedem R, Levin D, et al. Acne and obesity: A nationwide study of 600,404 adolescents. *J Am Acad Dermatol.* 2019; 81(3): 723-729.

11. Elsaie ML. Hormonal treatment of acne vulgaris: an update. *Clin Cosmet Investig Dermatol*. 2016; 9: 241-248.
12. Ekiz O, Balta I, Unlu E, Bulbul Sen B., Rifaioğlu EN, Dogramaci AC. Assessment of thyroid function and lipid profile in patients with postadolescent acne in a Mediterranean population from Turkey. *Int J Dermatol*. 2015; 54(12):1376-1381.
13. Di Landro A, Cazzaniga S, Cusano F, Bonci A, Carla C, Musumeci ML, et al. Group for Epidemiologic Research in Dermatology Acne Study Group. Adult female acne and associated risk factors: Results of a multicenter case-control study in Italy. *J Am Acad Dermatol*. 2016; 75(6):1134-1141.e1.
14. Richter C, Trojahn C, Hillmann K, Dobos G, Kanti V, Vogt A, et al. Sensitivity to change of the Dermatology Life Quality Index in adult females with facial acne vulgaris: a validation study. *J Eur Acad Dermatol Venereol*. 2017; 31(1):169-174.
15. Anaba EL, Oaku IR. Adult female acne: A cross-sectional study of diet, family history, body mass index, and premenstrual flare as risk factors and contributors to severity. *Int J Womens Dermatol*. 2020; 7(3): 265-269.
16. Halvorsen JA, Vleugels RA, Bjertness E, Lien L. A population-based study of acne and body mass index in adolescents. *Arch Dermatol*. 2012; 148(1):131-132.
17. Lu PH, Hsu CH. Body mass index is negatively associated with acne lesion counts in Taiwanese women with post-adolescent acne. *J Eur Acad Dermatol Venereol*. 2015; 29(10): 2046-2050.
18. Tsai MC, Chen W, Cheng YW, Wang CY, Chen GY, Hsu TJ. Higher body mass index is a significant risk factor for acne formation in schoolchildren. *Eur J Dermatol*. 2006;16(3): 251-253.
19. Sas K, Reich A. High Body Mass Index is a Risk Factor for Acne Severity in Adolescents: A Preliminary Report. *Acta Dermatovenerol Croat*. 2019; 27(2): 81-85.
20. Hasrat NH, Al-Yassen AQ: Lipid profile among acne patients attending Al-Fayhaa Teaching Hospital in Basrah, Iraq. *J Xi'an Shiyou Univer*. 2022; 8: 934-939.
21. Hasrat NH, Al-Yassen AQ. The Relationship Between Acne Vulgaris and Insulin Resistance. *Cureus*. 2023;15(1): e34241.

العلاقة بين مؤشر كتلة الجسم وحب الشباب - دراسة مقارنة

الخلفية: حب الشباب هو مرض التهابي مزمن يصيب الوحدة الشعرية الدهنية التي تصيب عادة المراهقين. هناك عوامل متعددة متورطة في التسبب في حب الشباب الشائع ، وهناك اهتمام متزايد بدراسة تأثير السمنة ومؤشر كتلة الجسم (BMI) على تطور حب الشباب الشائع.

الأهداف: تهدف هذه الدراسة إلى تقييم العلاقة بين مؤشر كتلة الجسم وحدوث حب الشباب الشائع بالإضافة إلى الارتباط بين مؤشر كتلة الجسم وشدة حب الشباب.

الطريقة: تم إجراء دراسة الحالات والشواهد في العيادة الخارجية للأمراض الجلدية بمستشفى الفيحاء التعليمي في مدينة البصرة. تم قياس مؤشر كتلة الجسم لـ ٢٠١ من مرضى حب الشباب الشائع الذين كانوا متطابقين مع العمر والجنس مع ٢٠٣ عناصر تحكم.

النتائج: وجدت الدراسة الحالية أن نسبة زيادة الوزن والسمنة كانت أعلى بين مرضى حب الشباب الشائع (٢٦,٨٦٪ و ٨,٤٥٪ على التوالي) مقارنة بالضابطة (١٥,٧٦٪ و ١,٤٨٪ على التوالي) ، خاصة بين الإناث قبل المراهقة. (P-value) = 0.001. ارتبط ارتفاع مؤشر كتلة الجسم بشكل كبير بحب الشباب الشديد ، وكان هناك ارتباط إيجابي معنوي بين مؤشر كتلة الجسم ودرجة شدة حب الشباب العالمية (ص = ٠,٨٣٠ ، قيمة P = 0.001).

الاستنتاج: زيادة مؤشر كتلة الجسم يرتبط بزيادة في حدوث وشدة حب الشباب الشائع.