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Original Article

Relationship of Triglyceride Levels and Body Mass Index with Acne Vulgaris Severity in Students of the Faculty of Medicine, Universitas Sumatera Utara

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Abstract

Background Acne vulgaris is a chronic inflammatory disorder impacting the pilosebaceous follicles, manifesting as comedones, papules, pustules, and nodules. Research suggests that elevated triglyceride levels correlate with increased acne severity. Triglycerides, a form of lipid present in the bloodstream and various organs, influence androgen hormone synthesis and sebum secretion, potentially exacerbating acne vulgaris.

Objective This study aims to investigate the correlation between triglyceride levels, body mass index (BMI), and the severity of acne vulgaris.

Methods Ninety five medical students at Universitas Sumatera Utara diagnosed with acne vulgaris were enrolled in the study. Participants' triglyceride levels were measured through a lipid profile, and acne severity was categorized according to the Lehmann classification method. Body Mass Index (BMI) data were recorded for each participant.

Results Among the participants, for optimal triglyceride levels, the negative parameter estimate (-1.300), The *P*-value of .007 signifies that this association is statistically significant. This indicates that individuals with optimal triglyceride levels are less prone to severe acne compared to those with high or very high triglyceride levels. Borderline-high triglyceride levels showed a negative parameter estimate (-1.249), suggesting a possible inverse association with acne severity; however, this result did not reach statistical significance (*P*-value=.0061). The association between BMI and the severity of acne vulgaris was not statistically significant, as evidenced by *P*-values >.05 all BMI categories.

Conclusion The study identified a substantial correlation between triglyceride levels and the severity of acne vulgaris. Nonetheless, no substantial correlation was observed BMI and acne severity.

Keywords Acne vulgaris; Body Mass Index; Triglycerides.

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Introduction

Acne vulgaris (AV) is a chronic inflammatory condition affecting the pilosebaceous follicles, manifesting as comedones, papules, pustules, and nodules. It affects 85% of teenagers and generally starts in preadolescense in sebaceous gland-rich areas such as face, chest, and back.[1] Although acne vulgaris is not life-threatening, it can reduce self-

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esteem and causes psychological distress.[2] The pathogenesis of acne involves multiple factors, including increased sebum production, aberrant follicular keratinization, Cutibacterium acnes colonization, and inflammation.[3] Cutibacterium acnes secretes a lipase enzyme that breaks down sebum triglycerides into glycerol and fatty acids, causing comedones and inflammation.

Some research links high triglycerides to AV severity. Jisha *et al*. showed that AV patients had greater triglycerides levels than healthy controls, but no other lipid parameters were significantly different.[4] However, Nasution *et al*. found no link between lipid profiles, particularly triglycerides and AV.[5] Mohammed *et al*. found increased triglycerides in AV patients compared to controls, underscoring metabolic variables' complexity in acne pathogenesis.[6] Diet, including dairy, can cause AV. Juhl *et al*. found in a systematic review and meta-analysis that dairy comsumption increases acne risk in 7-30 years old.[7] Understanding these correlations can help identify dietary therapies for AV and triglycerides.

Recent studies have suggested that metabolic factors may contribute to acne development. Several studies reported higher triglyceride levels in patients with acne compared to healthy controls. However, findings remain inconsistent, as some studies found no significant association between lipid profiles and acne severity.

Despite these findings, the relationship between metabolic parameters, particularly triglycerides and BMI, and acne vulgaris remains unclear. Moreover, limited research has examined this association in young adult populations such as medical students, who may experience high academic stress, irregular lifestyle patterns, and dietary habits that could influence both metabolic status and acne development.

Therefore, this study aimed to evaluate the association between triglyceride levels, BMI, and acne vulgaris among medical students.

Methods

This study used a cross-sectional design to examine triglyceride levels, height, and weight at Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia, from June to November 2023. After approval from University Ethical Review Board (vide Ref. No. 768/KEPK/USU/2023 dated 14.08.2023), 95 participants from Universitas Sumatera Utara Medical Faculty students with non probability sampling technique using purposive sampling following inclusion and exclusion criteria by using Slovin formula $N = \frac{N}{1 + N(e^2)}$ (N=1008, e=0.05). Dermatologists diagnosed all participants with AV and classified AV using the Lehmann classification. All participants gave informed consent before joining the study. All data were subsequently utilized in statistical analysis using SPSS to investigate any potential association with the severity of AV.

The inclusion criteria was; Universitas Sumatera Utara Medical Faculty students from mild, moderate, or severe AV, according to Lehmann classification. The population that signed informed consent after being properly informed about the research.

The exclusion criteria was; a pregnant or breastfeeding, taking lipid-metabolizing drugs, and heart disease-prone population.

This study poses no harm to participants. Researchers handled data securely and confidentially.

Height was measured using stadiometer. Participants were instructed to remove their footwear and stand upright with heels and buttocks touching the measuring board. The investigator then recorded the height measurement.

Body weight was measured using a digital scale. Participants removed their footwear and stood on the scale, and the investigator recorded the weight measurement.

Body mass index (BMI) was calculated by dividing body weight in kilograms by the square of height in meters (kg/m^2), using the following formula [BMI = Weight(kg) / Height^2(m^2)]. Participants were categorized based on their BMI results, including severe underweight (<17.0), mild underweight (17.0-18.4), normal weight (18.5-25.0), mild obese (25.1-27.0), and severe obese (>27.0).

Lehmann's classification grade AV severity based on lesion number, type, and contribution using the following criteria:

1. *Mild AV*: few comedones and minimal irritation that affect minor face areas.
2. *Moderate AV*: comedones, papules, and pustules increases in number. Acne may spread to other facial regions with inflammation.
3. *Severe AV*: pustules, nodules, and cysts are common. Acne vulgaris can cover vast portions of the face, causing scarring and inflammation.

Triglycerides levels were assessed via lipid profile test. Blood sample were obtained from each participant following a 12-hours fasting interval to guarantee precise measurement of triglyceride levels. Blood was obtained using venepuncture on the fingertip and triglyceride levels were examined with measuring instrument 'Lipid Pro' and triglyceride strip. Participants were categorized into groups bases on their lipid profiles results, including optimum (<150 mg/dL), borderline high (150-199 mg/dL), high (200-499 mg/dL), and extremely high (>499 mg/dL) triglyceride levels.

Statistical analysis was performed to assess the association between triglyceride levels and the severity of AV among students of the Faculty of Medicine, Universitas Sumatera Utara. The correlation of these variables was analysed using the Chi-square test. A *P*-value of <.05 was considered statistically significant.

Result

A total of 95 medical students with acne vulgaris were included in this study. Most participants were female (72.6%), and mild acne was the most common severity category (60%). Optimal triglyceride levels were observed in 51.6% of participants, while most participants had a normal BMI (51.6%).

Ordinal logistic regression analysis showed that the final model including triglyceride levels and BMI provided a better fit than the intercept-only model (χ^2=13.787, df=5, *P*=.017).

Table 1 shows baseline characteristics for the study participants (n=95).

Table 2 shows model fitting information for ordinal logistic regression analysis.

Table 3 shows the parameter estimates for factors associated with acne vulgaris severity. The interpretation of these estimates is as follows:

Multiple Comparison Adjustment A Bonferroni

Table 1 Baseline characteristics.

Characteristic	*Number of subjects*	*Weighted percent*
Sex		
Male	26	27.4%
Female	69	72.6%
Acne vulgaris		
Mild	57	60%
Moderate	27	28.4%
Severe	11	11.6%
Triglyceride		
Optimal	49	51.6%
Borderline high	15	15.8%
High	29	30.5%
Very high	2	2.1%
Body mass index		
Severe underweight	4	4.2%
Mild underweight	13	13.7%
Normal	49	51.6%
Mild obese	13	13.7%
Severe obese	16	16.8%
Valid	95	100%

Table 2 Model fitting information

Model	*-2 log likelihood*	*Chi-square*	*df*	*Sig*
Intercept only	67.914	13.787	5	0.017
Final	54.128			

Table 3 Parameter estimation.

Parameter	*Estimation*	*Sig*	*95% Confidence Interval*	
			Lower Bound	*Upper Bound*
Acne vulgaris				
Mild	- 0.890	0.099	-1.947	0.167
Moderate	0.931	0.090	-0.144	0.2006
Triglyceride				
Optimal	- 1.300	0.007	-2.238	-0.361
Borderline high	- 1.249	0.061	-2.557	0.060
High and very high	0			
Body Mass Index (BMI)				
Underweight	- 1.285	0.101	-2.821	0.250
Normal	- 0.258	0.644	-1.350	0.835
Mild obese	- 0.991	0.209	-2.537	0.554
Severe obese	0			

Table 4 Odds ratio (OR).

Variable	*Odds ratio*	*95% confidence interval*
Triglyceride		
Optimal	1.816	1.134-2.908
Borderline high, High and Very high	0.484	0.303-0.775
Body Mass Index		
Severe, Mild underweight, Normal	1.034	0.720-1.485
Mild obese, Severe obese	0.952	0.562-1.612

correction was used to account for Type I errors when triglyceride levels were divided into optimum, borderline-high, high, and very high. After applying Bonferroni correction for multiple comparisons (0.0125), the association between optimal triglyceride levels and acne severity remained statistically significant.

Interpretation of Findings

- Triglyceride levels were significantly associated with acne severity. Participants with optimal triglyceride levels had lower odds of severe acne compared with those with high or very high triglyceride level (-1.300, *P* value=.007). borderline-high triglyceride levels showed a similar trend (-1.249), although this association did not reach statistical significance (*P* value=.061).
- In contrast, BMI categories were not significantly associated with acne severity in the regression analysis (all *P* values >.05).

Table 4 shows the odds ratio (OR) of triglyceride levels and body mass index for acne vulgaris severity. The interpretation of these estimates:

- *Optimal:* participants with optimal triglyceride levels showed higher odds of having lower acne severity compared with those with high or very high triglyceride levels (OR = 1.816; 95% CI: 1.134-2.908)

- *Borderline high, high, and very high*: its OR of 0.484 (CI=0.303-0.775) shows a lower risk than the reference group. The CI doesn't cross 1, showing statistical significance.

- *Severe, mild underweight, normal*: an OR of 1.034 (CI=0.720-1.485) implies no risk difference from the reference group. CI crosses 1, hence result is not significant.

- *Mild obese, severe obese*: an OR of 0.952 (CI=0.562-1.612) suggests no meaningful difference. CI crosses 1, hence result is not significant.

Discussion

Female students had more acne than male students, with 69 women (72.6%) and 26 males (27.4%). This supports Skroza *et al*. finding that AV is more frequent in women. Multiple factors, including hormonal changes during menstruation and adolescence, cause this gender gap. Menstrual cycles affect estrogen and progesterone levels, which can affect AV severity, according to research. Increased free androgen and dehydroepiandrosterone sulfate (DHEAS) during perimenstrual flare-up cause hormonal changes and AV aggravation.[8,9] Puberty hormones, which enhance DHEAS production, also contribute to AV.[10] According to Sutaria *et al*;

puberty increases 5-alpha reductase activity, which converts testosterone into DHT, which increases follicular hyperproliferation and sebum production, two key factors in AV.[11]

This study found a strong correlation between triglyceride levels and acne severity (*P* value=.007). This finding indicates that higher triglycerides levels were associated with greater acne severity in this study population.[8,12] El-Akawi *et al*. in Ordania likewise identified a link between triglycerides and AV severity.[13] Jisha *et al*. in India and Hasrat & Al-Yassen in Iraq, AV patients had higher triglycerides than healthy controls, but other lipid profiles were similar.[12] Not all studies support this link. Nasution *et al*. in Medan and Romanska-Gocka *et al*. in Poland found no correlation between triglycerides and AV severity.[5,14] These discrepancies may be due to study design, population characteristics, or regional factors that affect lipid metabolism and AV severity.

One of the most well-establish relationships between triglycerides and AV is androgens stimulating sebaceous glands. Triglycerides stimulate androgen production, which can cause sebum overproduction. Sebum and dead skin cells restrict pores and foster acne-causing bacteria.[15] Studies suggest that increased triglycerides release pro-inflammatory cytokines, promoting inflammation.[13] Bacterial enzymes can break down skin triglycerides into free fatty acids, which may worsen clogged hair follicle inflammation. Acne vulgaris causes redness, edema, and pain due to inflammation. Triglycerides may influence skin lipids and barrier function. High triglycerides can disturb the skin's natural lipids, impairing the skin barrier and making it more prone to infection and discomfort.[15] Triglycerides may combine with nutrition, hereditary, and hormonal regulation to cause acne, making it a complicated and multifaceted.[16]

Based on previous research by Anaba and Oaku & Alowirdhi *et al*; BMI didn't significantly affect AV.[15,17] The intricate interaction of genetic, hormonal, and environmental factors in AV development may explain why BMI does not affect AV severity. Even though this study found no significant association, the relationship between BMI and AV is still contested due to lack of scientific data.[15] Multiple causes cause AV, but hormones, especially androgens, increase sebum production and clog pores, while BMI may be a proxy for lifestyle factors that affect hormones, but it doesn't explain how hormonal changes cause AV.[18]

Reason for this lack correlation include AV multifactorial nature such as genetics, hormonal changes, food, and skin care. Obese people have higher insulin or Insulin like Growth Factor-1 (IGF-1) levels, which may affect AV, but BMI is only one part of hormonal picture. Body Mass Index alone may not be a good predictor of AV severity, especially in young, healthy people without metabolic dysfunctions such as obesity and hyperandrogenism. Hyperandrogenism and insulin resistance caused by obesity increase sebaceous gland activity and AV.[7]

The current study's participants were mostly young adults (18-23 years old), many of whom may not have reached an age where BMI-related metabolic disorders like insulin resistance affect AV. This age group may still have acne due to hormonal changes during puberty and early adulthood, which may outweigh BMI.[11]

In conclusion, while triglyceride levels show a significant relationship with acne vulgaris severity in this study, the relationship between BMI and acne remains inconclusive. This underscores the complexity of acne pathophysiology, where both genetic and environmental factors, including hormonal fluctuations, lipid metabolism, and body composition, contribute to the development and severity of the condition. Further research with larger, more diverse populations is needed to explore these relationships in greater depth and to identify more effective prevention and treatment strategies for acne vulgaris.

Conclusion

This study identified a significant association between triglyceride levels and acne vulgaris severity among medical students, whereas BMI showed no significant relationship. However, the cross-sectional design limits causal interpretation. Future longitudinal studies with larger and more diverse populations are needed to clarify the role lipid metabolism and other metabolic factors in acne pathogenesis.

Limitations of study and Context This study focus on a specific student population at the Faculty of Medicine at Universitas Sumatera Utara. This is significant because university students are often at a life stage marked by significant hormonal, nutritional, and psychological changes, which may influence acne severity in ways that differ from the general population. Additionally, the study adds to the literature by providing data from an Indonesian cohort, where the relationship between triglycerides, BMI, and acne has been less explored compared to Western or other Asian populations.

Moreover, the study employs rigorous statistical methods, using multiple ordinal regression analysis, to examine the relationships between triglyceride levels, BMI, and acne severity. The findings underscore the importance of considering triglycerides as a modifiable factor in acne treatment, particularly for patients who may have elevated lipid levels. The study also highlights the need for further research into the mechanisms underlying the complex interaction between lipid metabolism, hormones, and acne vulgaris, particularly in diverse populations.

Declaration of patient consent Authors certify that they have obtained all appropriate patient consent.

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Conflict of interest No conflict of interest.

Author's contribution

KAH, DAD, JJ: Substantial contribution to study design, acquisition of data and manuscript writing. Has given final approval of the version to be published.

Every author has given final approval of the manuscript version to be published and agreed to be accountable for all aspects of the work.

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