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PREVALENCE OF METABOLIC SYNDROME IN ACNE VULGARIS AND ITS CLINICAL CORRELATES

Dermatology

Dr. T Neha Singh Junior resident , Sri Siddhartha medical college and hospital

Dr.Veena* Professor,sri Siddhartha medical college and hospital*Corresponding Author

ABSTRACT

Background Acne vulgaris is a chronic inflammatory disorder of the pilosebaceous unit, traditionally considered a localized skin disease. Emerging evidence suggests a systemic association with metabolic syndrome, a cluster of abnormalities including central obesity, insulin resistance, dyslipidemia, hypertension, and impaired glucose tolerance. Shared mechanisms such as hyperinsulinemia, androgen excess, chronic inflammation, oxidative stress, and mTORC1 pathway activation indicate a common biological link. This study aims to evaluate the frequency of metabolic syndrome in patients with acne vulgaris.**Methodology** This hospital-based cross-sectional study was conducted over 24 months (January 2024–January 2026) in a dermatology outpatient department, including 74 patients with acne vulgaris selected by purposive sampling. Patients aged 10–65 years were included; those with steroid-induced acne or pregnant/lactating were excluded. After informed consent, clinical and dermatological evaluation with acne grading using GAGS was performed. Anthropometry, blood pressure, fasting blood glucose, and lipid profile were assessed. Metabolic syndrome was diagnosed using modified NCEP-ATP III criteria for South Asians.**Results** Among 74 patients (mean age 24.32 ± 7.29 years; 56.76% males), most were aged 20–29 years (62.16%) and had severe acne (64.86%). Disease duration of 1–5 years (72.97%) was significantly associated with severity (p=0.002). Metabolic syndrome was present in 64.86% but showed no significant association with acne severity (p=0.397). Low HDL was significantly associated with severity, while a high glycemic diet (78.38%) showed a strong association (p<0.001). Other factors were not significant.**Conclusion** Acne vulgaris, particularly in moderate-to-severe and persistent forms, is associated with metabolic syndrome and may serve as a marker of underlying metabolic dysfunction. Early screening may help reduce long-term cardiometabolic risk.

KEYWORDS

Acne Vulgaris; Metabolic Syndrome; Insulin Resistance; Dyslipidemia; Central Obesity

INTRODUCTION

Acne vulgaris is a common chronic inflammatory disorder of the pilosebaceous unit affecting adolescents and adults worldwide[1]. Traditionally considered a benign condition, recent evidence suggests its association with systemic metabolic abnormalities, indicating that acne may serve as a cutaneous marker of underlying metabolic dysfunction[2]. Metabolic syndrome comprises a cluster of conditions including central obesity, insulin resistance, dyslipidemia, hypertension, and impaired glucose tolerance, all of which increase the risk of type 2 diabetes and cardiovascular disease[3].

Insulin resistance plays a central role by causing hyperinsulinemia, which increases androgen production and reduces sex hormone-binding globulin levels, thereby promoting sebaceous gland activity and follicular hyperkeratinization[4]. Activation of insulin-like growth factor-1 (IGF-1) and mTORC1 pathways further contributes to increased sebum production and comedogenesis[5]. Factors such as high glycemic diet, obesity, chronic inflammation, and oxidative stress also link acne with metabolic syndrome.

Recognizing this association has important clinical implications, as early detection of metabolic abnormalities in acne patients may help prevent long-term complications. Therefore, this study aims to evaluate the prevalence of metabolic syndrome in patients with acne vulgaris.

OBJECTIVES

1. To determine the prevalence of metabolic syndrome and its individual components among patients with acne vulgaris.
2. To describe the clinical profile of acne vulgaris patients diagnosed with metabolic syndrome.

Materials and Methods

This hospital-based cross-sectional study was conducted in the Department of Dermatology, Venereology, and Leprosy at Sri Siddhartha Medical College and Hospital, Tumkur, Karnataka, over 24 months (January 2024–January 2026). Patients aged 10–65 years[6] with clinically diagnosed acne vulgaris were included, irrespective of severity, duration, or treatment status. Those with steroid-induced acne, coexisting dermatological conditions affecting diagnosis, and pregnant or lactating females were excluded.

A non-probability purposive sampling method was used, recruiting consecutive eligible patients until the required sample size (n=74) was achieved. Sample size was calculated based on a reported prevalence of 26.2% using the formula $n = (Z_{1-\alpha/2}^2 \times p(100-p)) / d^2$, where $Z_{1-\alpha/2}$ = 1.96 (95% confidence), p = 26.2%, and d = 10%, with 80% power. Data were collected using a structured proforma including sociodemographic details, clinical and treatment history, comorbidities, and family history. Acne severity was graded using the Global Acne Grading System (GAGS)[7]. Anthropometric measurements (height, weight, BMI, waist circumference) and blood pressure were recorded.

After 8–12 hours of fasting, venous blood samples were collected. Fasting blood glucose was estimated by the glucose oxidase method, and lipid profile (total cholesterol, triglycerides, HDL) by enzymatic methods; LDL and VLDL were calculated using the Friedewald formula.

Metabolic syndrome was diagnosed using modified NCEP-ATP III criteria for South Asians (≥3 of the following):

Criterion	Definition
Waist circumference	≥90 cm (males), ≥80 cm (females)
Triglycerides	≥150 mg/dL
HDL cholesterol	<40 mg/dL (males), <50 mg/dL (females)
Blood pressure	≥130/85 mmHg or on treatment
Fasting blood glucose	≥100 mg/dL or on treatment8

RESULTS

A total of 74 patients with acne vulgaris were included in the study. The majority belonged to the 20–29 years age group (62.16%), followed by 10–19 years (21.62%), with a mean age of 24.32 ± 7.29 years. Males constituted 56.76% of the study population, showing a slight male predominance. Most participants were from rural areas (74.32%), and students formed the largest occupational group (55.41%).

Regarding disease characteristics, the majority of patients had a disease duration of 1–5 years (72.97%). A high glycemic diet was reported in 78.38% of patients, and 54.05% had a positive family history of acne. Among female patients, 53.13% reported irregular menstrual cycles, and premenstrual flare was observed in 96.88%. Hirsutism was present in 31.25% of females. Smoking was noted in 10.81% of patients, while acanthosis nigricans was observed in 35.14% of cases.

In terms of acne severity, Grade IV acne was most common (64.86%), followed by Grade III (25.68%), Grade II (8.11%), and Grade I (1.35%). Metabolic syndrome was present in 64.86% of patients, indicating a high prevalence among individuals with acne vulgaris.

\Analysis of metabolic parameters across acne severity grades showed

no statistically significant differences in waist circumference (p=0.37), systolic blood pressure (p=0.21), triglyceride levels (p=0.839), or fasting blood glucose (p=0.741). However, HDL levels showed a statistically significant difference (p=0.007), with lower levels observed in patients with more severe acne.

Chi-square analysis demonstrated no significant association between acne severity and variables such as age (p=0.137), gender (p=0.403), family history (p=0.203), menstrual irregularity (p=0.293), premenstrual flare (p=0.377), hirsutism (p=0.472), smoking (p=0.781), acanthosis nigricans (p=0.397), and metabolic syndrome (p=0.397). However, a statistically significant association was found between high glycemic diet and acne severity (p<0.001), indicating that patients consuming high glycemic diets were more likely to have severe acne.

Further analysis showed a significant association between duration of acne and severity grade (p=0.002), with longer duration correlating with increased severity. No significant associations were observed between menstrual cycle irregularity, premenstrual flare, or hirsutism and metabolic syndrome among female patients9.

Descriptive analysis revealed mean waist circumference of 88.74 ± 11.81 cm, systolic blood pressure of 123.22 ± 7.20 mmHg, diastolic blood pressure of 79.24 ± 8.61 mmHg, HDL levels of 44.21 ± 9.78 mg/dL, triglycerides of 131.27 ± 70.99 mg/dL, and fasting blood glucose of 100.72 ± 24.90 mg/dL.

Table 1: Association Between Acne Severity Grade and Selected Demographic, Lifestyle, Hormonal, and Metabolic Variables (Chi-square Analysis)

Variable		Grade n (%)				df	Chi-square Calculated	P-Value
		I	II	III	IV			
Age Group	< 25	1 (100.00)	2 (33.33)	13 (68.42)	37 (77.08)	2	5.5241	0.137
	≥ 25	0 (0.00)	4 (66.67)	6 (31.58)	11 (22.92)			
Gender	Female	0 (0.00)	2 (33.33)	11 (57.89)	19 (39.58)	2	2.9257	0.403
	Male	1 (100.00)	4 (66.67)	8 (42.11)	29 (60.42)			
Family History	Absent	1 (100.00)	2 (33.33)	12 (63.16)	19 (39.58)	2	4.2506	0.203
	Present	0 (0.00)	4 (66.67)	7 (36.84)	29 (60.42)			
High Glycemic Diet	Absent	0 (0.00)	5 (83.33)	6 (31.58)	5 (10.42)	2	18.427	<0.001
	Present	1 (100.00)	1 (16.67)	13 (68.42)	43 (89.58)			
IRREGULAR CYCLES (Female Only)	Irregular	0 (0)	0 (0)	6 (54.55)	11 (57.89)	2	2.4491	0.293
	Regular	0 (0)	2 (100)	5 (45.45)	8 (42.11)			
PREMENSTRUAL FLARE (Female Only)	Absent	0 (0)	0 (0)	1 (9.09)	0 (0)	2	0.3733	0.377
	Present	0 (0)	2 (100)	10 (90.91)	19 (100)			
Hirsutism (Female Only)	Absent	0 (0)	2 (100)	19 (65.52)	1 (100)	2	1.5047	0.472
	Present	0 (0)	0 (0)	10 (34.48)	0 (0)			
Smoking Addiction	Absent	1 (100.00)	5 (83.33)	18 (94.74)	42 (87.50)	2	1.0831	0.781
	Present	0 (0.00)	1 (16.67)	1 (5.26)	6 (12.50)			
Acanthosis Nigricans	Absent	0 (0.00)	5 (83.33)	13 (68.42)	30 (62.50)	2	2.9673	0.397
	Present	1 (100.00)	1 (16.67)	6 (31.58)	18 (37.50)			
Metabolic Syndrome	Absent	1 (100.00)	1 (16.67)	6 (31.58)	18 (37.50)	2	2.9373	0.397
	Present	0 (0.00)	5 (83.33)	13 (68.42)	30 (62.50)			

Overall, the findings indicate a high prevalence of metabolic syndrome among acne vulgaris patients, with significant associations observed for dietary factors and disease duration, while most demographic and hormonal variables did not show statistically significant correlations.

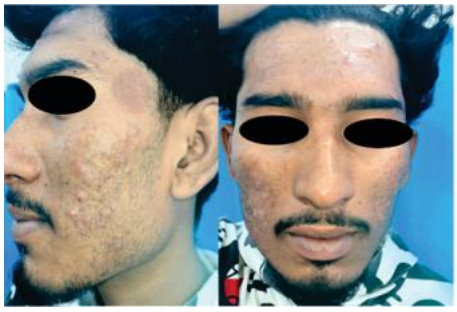

Fig 1 : A 32-year-old male with a 3-year history of Grade 4 acne vulgaris had history of smoking since 4 yrs and a positive family history. Clinical evaluation revealed a waist circumference of 91 cm, triglycerides of 164 mg/dL, HDL of 46 mg/dL, fasting blood sugar of 103 mg/dL, and blood pressure of 126/86 mmHg. With 4 out of 5 criteria met, he is diagnosed with metabolic syndrome.

Fig 2: A 20-year-old male with a 4-year history of Grade 4 acne vulgaris reports smoking history since past 2 years and a positive family history. Clinical evaluation showed a waist circumference of 86 cm, triglycerides of 154 mg/dL, HDL of 42 mg/dL, fasting blood sugar of 102 mg/dL, and blood pressure of 120/80 mmHg. As 4 out of 5 criteria are met, he is diagnosed with metabolic syndrome.

DISCUSSION

The present study aimed to evaluate the frequency of metabolic syndrome (MetS) in patients with acne vulgaris and its association with disease severity, demographic variables, lifestyle factors, hormonal influences, and metabolic parameters. The findings support the growing recognition of acne as not merely a localized dermatological condition but a potential cutaneous marker of systemic metabolic dysfunction.

A key observation was the high prevalence of metabolic syndrome (64.86%) in a relatively young cohort (mean age 24.32 ± 7.29 years). This prevalence is notably higher than that reported in previous Indian studies, such as Podder et al. (32%)10, Chandak et al. (26.2%)11and Badabagni et al. (52.4%)12, as summarized in Table 2. This discrepancy may be attributed to differences in study design, diagnostic criteria, and notably, the higher proportion of severe acne cases in the present study. Despite the younger age group compared to studies like Badabagni et al. (mean age 38.5 years)13, the elevated MetS prevalence highlights the possibility of early onset metabolic abnormalities in acne patients.

The study population demonstrated a predominance of severe acne (Grade IV: 64.86%), which contrasts with earlier studies that reported mainly mild-to-moderate acne (e.g., Podder et al. and Chandak et al.)10,11. A similar trend toward severe acne was observed in Bungau

et al12. (61.54%). This skewed severity distribution likely reflects the hospital-based sampling and may partly explain the higher metabolic burden observed.

Interestingly, no significant association was found between metabolic syndrome and acne severity, a finding consistent with several previous studies. This suggests that metabolic abnormalities may be present across all grades of acne rather than being limited to severe disease. However, the uneven distribution of severity in the present study may have limited the ability to detect such associations.

Among metabolic parameters, HDL cholesterol showed a significant inverse association with acne severity (p=0.007), with lower levels observed in severe acne. This aligns with findings from Badabagni et al13. and Bungau et al12., supporting the role of dyslipidemia—particularly reduced HDL—in acne pathogenesis. In contrast, other parameters such as fasting blood glucose, triglycerides, and waist circumference did not show significant associations with severity, consistent with observations by Chandak et al10., suggesting that these factors contribute more to overall metabolic risk than to acne severity per se.

Lifestyle factors, particularly high glycemic diet, demonstrated a strong association with acne severity (p<0.001), reinforcing the role of insulin and IGF-1–mediated pathways in acne development. This is in agreement with existing literature emphasizing dietary influences on acne. Although acanthosis nigricans (35.14%) was relatively common in the present study, comparable to findings by Dabukke YJS (47.33%) 14. it did not show a significant association with acne severity, though it remains a valuable clinical indicator of insulin resistance.

Hormonal factors in female patients, including menstrual irregularities, premenstrual flares, and hirsutism, were frequently observed but did not demonstrate significant associations with either acne severity or metabolic syndrome. Similarly, family history and smoking did not show significant correlations, suggesting that metabolic and lifestyle factors may play a more prominent role than genetic or hormonal factors alone in determining disease severity in this cohort.

The significant association between duration of acne and severity (p=0.002) highlights the progressive nature of the disease and underscores the importance of early and effective intervention to prevent severe presentations.

Overall, the present study demonstrates a higher burden of metabolic syndrome and severe acne compared to many previous studies, while maintaining consistency in key findings such as the lack of association between MetS and acne severity and the role of low HDL levels. These findings emphasize the need for routine metabolic screening in acne patients, particularly in those with persistent or severe disease, to facilitate early identification and management of metabolic risk factors.

Table 2 : Comparison of Acne Vulgaris and Metabolic Syndrome Parameters of Present study with Previous Studies

Study	Sample Size (n)	Mean Age (years)	Predominant Acne Grade	Severe Acne (%)	Metabolic Syndrome (%)	HDL (mg/dL)	FBS (mg/dL)	Waist Circumference	Triglycerides (mg/dL)	Insulin Resistance / Acanthosis
Present Study	74	24.3 ± 7.3	Grade IV	64.86	64.86	41.76 ± 8.68 (Grade IV)	101.79 ± 25.50	89.94 ± 11.38 cm	128.06 ± 63.37	AN: 35.14 %
Podder et al., 2021 (India)	50 cases	21.0 ± 4.9	Mild	10.0	32.0	47.2 ± 6.7	94 .1 ± 6.6	31.7 ± 3.6 inches	98.7 ± 30.8	Not assessed
Badabagni et al., 2021 (India)	103	38.5 ± 11.2	Mild –Moderate	20.4	52.4	42.49 ± 5.94 (Severe)	119.5 ± 27.7	35.0 ± 3.8 inches	102.5 ± 26.7	Not assessed
Chandak et al., 2022 (India)	65 cases	23.4 ± 3.9	Grade II	6.2	26.2	44.11 ± 7.42	Elevated in 27.7 %	81.57 ± 9.54 cm	Elevated in 26.2%	Not assessed
Dabukke YJS (2023)	150	33.2 (19–58)	Mixed	—	—	—	IFG: 10.67%	BMI: 28.1 ± 7.9	—	HOMA-IR ≥2: 42.67 %; AN: 47.33 %
Bungau et al., 2024	159	23.8 ± 4.8	Severe	61.54	Metabolic clustering	47.73 ± 4.86	87.03 ± 8.49	BMI: 32.4 ± 4.79	NS	HOMA-IR: 2.55 ± 2.0

Strengths

This study provides a comprehensive evaluation of the clinico-metabolic profile of acne patients using standardized assessment tools. The inclusion of multiple variables, including dietary habits, hormonal factors, and metabolic parameters, allows for a holistic understanding of the disease. The use of objective measurements and statistical analysis strengthens the reliability of the findings.

Limitations

The cross-sectional design limits the ability to establish causality. The hospital-based sample with a predominance of severe acne may not represent the general population. The absence of a control group restricts comparison with non-acne individuals. Additionally, insulin resistance was not directly measured using indices such as HOMA-IR[15], and hormonal evaluation in females was not performed using standardized laboratory criteria.

Implications and Recommendations

The study highlights the need to consider acne vulgaris as a potential marker of systemic metabolic dysfunction. Routine screening for metabolic syndrome components—including waist circumference, blood pressure, fasting glucose, and lipid profile—should be incorporated into acne management, especially in moderate-to-severe cases. Lifestyle interventions, particularly dietary modification to reduce high glycemic intake, should be emphasized.

Future Scope

Further large-scale, multicentric, and longitudinal studies are needed to establish causal relationships between acne and metabolic syndrome. Inclusion of control groups, detailed hormonal evaluation, and measurement of insulin resistance parameters will provide deeper insights into the underlying pathophysiology[16].

CONCLUSION

The present study demonstrates a high prevalence of metabolic abnormalities, including metabolic syndrome, among patients with acne vulgaris, thereby fulfilling the study objectives. Although no significant association was observed between metabolic syndrome and acne severity, disease duration showed a significant correlation. **Low HDL cholesterol** was the only metabolic parameter significantly associated with increasing acne severity. A strong link between **high glycemic diet and acne severity** highlights the role of modifiable lifestyle factors. These findings support acne as a systemic condition and underscore the need for metabolic screening and lifestyle modification in its management.

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