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Original Article

Polycystic Ovary Syndrome and Metabolic Abnormalities Among Women Presenting with Moderate-to-Severe Acne

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ABSTRACT

Introduction: Polycystic ovary syndrome (PCOS) is a common endocrine disorder in reproductive-aged women and is frequently associated with hyperandrogenism, menstrual dysfunction, insulin resistance, and metabolic abnormalities. Acne, particularly when moderate to severe or persistent, may be an important cutaneous manifestation of androgen excess and can provide an opportunity to identify underlying PCOS. This study aimed to assess polycystic ovary syndrome and metabolic abnormalities among women presenting with moderate-to-severe acne. **Methods & Materials:** A cross-sectional analytical study was conducted in the Department of Dermatology, MH Samorita Hospital & Medical College, Dhaka, Bangladesh, from January 2025 to December 2025, among 105 women aged 18–35 years presenting with clinically diagnosed moderate-to-severe acne. Participants were included using a consecutive sampling technique until the required sample size was achieved. Data were analyzed using SPSS version 26.0. **Results:** Among 105 women with moderate-to-severe acne, the mean age was 26.1±4.7 years, and 40.0% were diagnosed with PCOS. PCOS was significantly associated with higher BMI and waist circumference, menstrual irregularity, hirsutism, acanthosis nigricans, hyperandrogenemia, insulin resistance, and elevated triglycerides. At least one metabolic abnormality was present in 69.0% of women with PCOS compared with 36.5% without PCOS (p=0.001), while severe acne was significantly associated with higher frequencies of PCOS (51.2%), hirsutism, menstrual irregularity, insulin resistance, and central obesity than moderate acne. **Conclusion:** The study revealed a substantial prevalence of PCOS and metabolic disturbances among women with moderate-to-severe acne, with 40.0% fulfilling the criteria for PCOS. PCOS was significantly linked to menstrual irregularities, hirsutism, acanthosis nigricans, increased BMI and waist circumference, hyperandrogenemia, insulin resistance, and dyslipidemia. Furthermore, women with severe acne had significantly higher frequencies of PCOS, insulin resistance, and central obesity, indicating a close relationship between acne severity and underlying endocrine-metabolic abnormalities.

Keywords: *Polycystic Ovary Syndrome, Metabolic Abnormalities, Acne*

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INTRODUCTION

Polycystic ovary syndrome (PCOS) is a common endocrine disorder of reproductive-age women, characterized by varying combinations of hyperandrogenism, ovulatory dysfunction and polycystic ovarian morphology. The 2023 International Evidence-Based Guideline recognizes PCOS as a heterogeneous condition with important reproductive, metabolic, dermatological and psychological consequences, and emphasizes that metabolic risk should be assessed irrespective of the presenting phenotype [1]. PCOS affects approximately 8–13% of reproductive-aged women when broader diagnostic criteria are applied, making it an important condition encountered across both gynecological and dermatological practice [1,2]. The metabolic phenotype of PCOS includes insulin resistance, impaired glucose tolerance, dyslipidemia, central adiposity, hypertension and metabolic syndrome, with these abnormalities contributing to the long-term risk of type 2 diabetes and cardiovascular disease [3-6]. Acne is one of the most frequent dermatological manifestations associated with androgen excess. Increased ovarian and adrenal androgen activity can enhance sebaceous gland activity, sebum production and follicular keratinization, thereby promoting persistent or severe acne [7,8]. Importantly, acne in adult women may sometimes represent a clinical clue to underlying endocrine dysfunction rather than an isolated cutaneous disorder. In a clinical study of 208 adult women with acne, PCOS was identified in 48.1%; younger age, premenstrual exacerbation and irregular menstruation were significantly associated with PCOS [7]. A multidisciplinary review has further emphasized that adult female acne may be a manifestation of androgen excess and that PCOS should be considered particularly when acne is accompanied by other clinical features of hyperandrogenism [8]. Recent evidence also supports a mechanistic interaction between hyperandrogenism and insulin resistance, whereby elevated insulin levels can increase ovarian androgen production and reduce sex hormone-binding globulin, thereby increasing free androgen exposure at target tissues, including the skin [9]. The metabolic significance of PCOS is substantial even beyond overt obesity. A systematic review and meta-analysis demonstrated that women with PCOS had approximately 3.35-fold higher odds of metabolic syndrome than women without PCOS [4]. Moreover, metabolic abnormalities are not confined to women with elevated body mass index. Among non-obese women with PCOS, the odds of insulin resistance were 5.70-fold higher, impaired glucose tolerance 3.42-fold higher, hypertriglyceridemia 10.46-fold higher and low HDL cholesterol 4.03-fold higher than in non-obese controls [5]. Longitudinal evidence likewise indicates increased risks of type 2 diabetes, dyslipidemia and other cardiometabolic outcomes in women with PCOS [3,6]. Recent data estimate that women with PCOS have a pooled relative risk of approximately 1.51 for cardiovascular disease, reinforcing the importance of identifying metabolic abnormalities early [10]. Despite this well-established metabolic burden, women presenting primarily with moderate-to-severe acne may be managed predominantly from a dermatological perspective, and underlying PCOS or metabolic abnormalities may remain

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unrecognized. Examining women with more clinically significant acne therefore provides an opportunity to identify an endocrine-metabolic phenotype at a potentially earlier stage. This study aimed to assess polycystic ovary syndrome and metabolic abnormalities among women presenting with moderate-to-severe acne.

METHODS & MATERIALS

A cross-sectional analytical study was conducted in the Department of Dermatology, MH Samorita Hospital & Medical College, Dhaka, Bangladesh, from January 2025 to December 2025, among 105 women aged 18–35 years presenting with clinically diagnosed moderate-to-severe acne. Participants were included using a consecutive sampling technique until the required sample size was achieved. Women aged 18–35 years with moderate-to-severe acne who provided written informed consent were included, while pregnant or lactating women, those with previously diagnosed endocrine disorders other than PCOS, established diabetes mellitus, severe systemic illness, and those receiving systemic hormonal therapy, hormonal contraceptives, systemic retinoids, or other medications likely to influence androgenic or metabolic parameters were excluded. Sociodemographic, menstrual, reproductive, and acne-related clinical information was collected using a structured questionnaire, and participants were examined for hirsutism, acanthosis nigricans, female-pattern hair loss, and other clinical features of hyperandrogenism. Height, weight, BMI, and waist circumference were measured, and laboratory investigations included fasting blood glucose, 2-hour post-load glucose, fasting insulin, lipid profile, total testosterone, DHEAS, and SHBG; insulin resistance was assessed using HOMA-IR. PCOS was diagnosed according to the 2023 International Evidence-Based Guideline for the Assessment and Management of PCOS, after exclusion of alternative causes. Data were analyzed using SPSS version 26.0; quantitative variables were expressed as mean ± SD and qualitative variables as frequency and percentage. Pearson's Chi-square test or Fisher's exact test was used for categorical variables, and $p<0.05$ was considered statistically significant. Ethical approval was obtained from the appropriate institutional ethical review committee, written informed consent was obtained from all participants, and confidentiality of the collected information was maintained throughout the study.

RESULTS

The mean age of the participants was 26.1 ± 4.7 years. Nearly half of the women, 48 (45.7%), were aged 18–24 years, followed by 34 (32.4%) aged 25–29 years and 23 (21.9%) aged 30–35 years. Most participants were from urban areas (72, 68.6%), while 33 (31.4%) were from rural areas. A total of 69 (65.7%) participants were unmarried, and 36 (34.3%) were married. Regarding educational attainment, 38 (36.2%) were graduates, 31 (29.5%) had completed higher secondary education, 24 (22.9%) had secondary-level education or below, and 12 (11.4%) were postgraduate educated (*Table I*).

Table I
Distribution of the study participants according to age, residence, marital status and educational status (*n*=105).

Characteristics	Frequency (n)	Percentage (%)
Age group (years)		
18–24	48	45.7
25–29	34	32.4
30–35	23	21.9
Mean age ± SD (years)	26.1 ± 4.7	
Residence		
Urban	72	68.6
Rural	33	31.4
Marital status		
Unmarried	69	65.7
Married	36	34.3
Education		
Secondary or below	24	22.9
Higher secondary	31	29.5
Graduate	38	36.2
Postgraduate	12	11.4

Among the participants, 62 (59.0%) had moderate acne, and 43 (41.0%) had severe acne. Acne had been present for 2–5 years in 48 (45.7%) women, while 29 (27.6%) had acne for less than 2 years and 28 (26.7%) for more than 5 years. Acne developed after menarche in 83 (79.0%) participants. Premenstrual aggravation was reported by 57 (54.3%). Clinical evidence of hirsutism was identified in 36 (34.3%), whereas acanthosis nigricans and female-pattern hair loss were observed in 18 (17.1%) and 14 (13.3%), respectively (*Table II*).

Table II
Distribution of participants according to acne severity and clinical characteristics (*n*=105).

Clinical characteristics	Frequency (n)	Percentage (%)
Acne severity		
Moderate	62	59.0
Severe	43	41.0
Acne duration		
<2 years	29	27.6
2–5 years	48	45.7
>5 years	28	26.7
Acne onset after menarche		
Yes	83	79.0
No	22	21.0
Premenstrual flare		
Present	57	54.3
Absent	48	45.7
Hirsutism		
Present	36	34.3
Absent	69	65.7
Acanthosis nigricans		
Present	18	17.1
Absent	87	82.9
Female-pattern hair loss		
Present	14	13.3
Absent	91	86.7

A regular menstrual cycle was reported by 67 (63.8%) participants, while 38 (36.2%) had menstrual irregularity. Oligomenorrhea was present in 31 (29.5%) and amenorrhea in 7 (6.7%) women. Dysmenorrhea was reported by 46 (43.8%) participants. Among the 36 married women, 18 (50.0%) had a previous pregnancy, and 7 (19.4%) reported a history of infertility (*Table III*).

Table III
Menstrual and reproductive characteristics of the study participants (*n*=105).

Characteristics	Frequency (n)	Percentage (%)
Regular menstrual cycle	67	63.8
Irregular menstrual cycle	38	36.2
Oligomenorrhea	31	29.5
Amenorrhea	7	6.7
Dysmenorrhea	46	43.8
Previous pregnancy among married women (n=36)	18	50.0
Previous infertility among married women (n=36)	7	19.4

The mean fasting blood glucose was 91.8 ± 11.7 mg/dL, while the mean 2-hour post-load glucose was 126.4 ± 26.9 mg/dL. Insulin resistance, defined by the study criterion for HOMA-IR, was observed in 28 (26.7%) participants. Dyslipidemic abnormalities included raised LDL-C in 22 (21.0%), low HDL-C in 25 (23.8%), elevated triglycerides in 21 (20.0%) and elevated total cholesterol in 17 (16.2%) participants. Elevated total testosterone was found in 31 (29.5%) women, while raised DHEAS was present in 18 (17.1%). Reduced SHBG was observed in 26 (24.8%) (*Table IV*).

Table IV
Biochemical and hormonal parameters of the study participants (*n*=105).

Parameter	Mean ± SD	Abnormal n (%)
Fasting blood glucose (mg/dL)	91.8 ± 11.7	9 (8.6)
2-hour post-load glucose (mg/dL)	126.4 ± 26.9	14 (13.3)
Fasting insulin (µIU/mL)	13.8 ± 8.2	29 (27.6)
HOMA-IR	3.1 ± 1.9	28 (26.7)
Total cholesterol (mg/dL)	182.6 ± 31.4	17 (16.2)
LDL-C (mg/dL)	111.7 ± 26.8	22 (21.0)
HDL-C (mg/dL)	46.2 ± 9.1	25 (23.8)
Triglycerides (mg/dL)	128.9 ± 48.6	21 (20.0)
Total testosterone (ng/dL)	53.7 ± 24.6	31 (29.5)
DHEAS (µg/dL)	238.6 ± 92.1	18 (17.1)
SHBG (nmol/L)	43.8 ± 18.5	26 (24.8)

PCOS was identified in 42 (40.0%) of the 105 women presenting with moderate-to-severe acne, whereas 63 (60.0%) did not fulfil the diagnostic criteria for PCOS. Thus, approximately two out of every five women with moderate-to-severe acne in the study population had coexisting PCOS (*Table V*).

Table V
Frequency of polycystic ovary syndrome among women with moderate-to-severe acne (*n*=105).

PCOS status	Frequency (n)	Percentage (%)
PCOS present	42	40.0
PCOS absent	63	60.0
Total	105	100.0

Women with PCOS had a significantly higher mean BMI (25.1 ± 4.1 vs. 22.8 ± 3.3 kg/m², p=0.002) and waist circumference (83.1 ± 9.7 vs. 76.9 ± 8.1 cm, p=0.001) than those without PCOS. Menstrual irregularity was markedly more common among women with PCOS (69.0% vs. 14.3%, p<0.001), as were hirsutism (59.5% vs. 17.5%, p<0.001), acanthosis nigricans (31.0% vs. 7.9%, p=0.003) and female-pattern hair loss (23.8% vs. 6.3%, p=0.014). Elevated testosterone was significantly more frequent in the PCOS group (52.4% vs. 14.3%, p<0.001). Insulin resistance was observed in 45.2% of women with PCOS compared with 14.3% without PCOS (p<0.001). Elevated triglycerides were also significantly more common in the PCOS group (31.0% vs. 12.7%, p=0.022), while the differences in low HDL-C and elevated LDL-C did not reach statistical significance (*Table VI*).

Table VI
Clinical and biochemical characteristics according to PCOS status (*n*=105).

Variable	PCOS (n=42) n (%) / Mean ± SD	No PCOS (n=63) n (%) / Mean ± SD	p-value*
Age (years)	26.8 ± 4.8	25.7 ± 4.6	0.231
BMI (kg/m²)	25.1 ± 4.1	22.8 ± 3.3	0.002
Waist circumference (cm)	83.1 ± 9.7	76.9 ± 8.1	0.001
Irregular menstruation	29 (69.0)	9 (14.3)	<0.001
Hirsutism	25 (59.5)	11 (17.5)	<0.001
Acanthosis nigricans	13 (31.0)	5 (7.9)	0.003
Female-pattern hair loss	10 (23.8)	4 (6.3)	0.014
Elevated testosterone	22 (52.4)	9 (14.3)	<0.001
Insulin resistance	19 (45.2)	9 (14.3)	<0.001
Elevated triglycerides	13 (31.0)	8 (12.7)	0.022
Low HDL-C	14 (33.3)	11 (17.5)	0.061
Elevated LDL-C	12 (28.6)	10 (15.9)	0.118

** Chi-square test.*

At least one metabolic abnormality was present in 29 (69.0%) women with PCOS compared with 23 (36.5%) women without PCOS (p=0.001). Two or more metabolic abnormalities were identified in 40.5% of women with PCOS compared with only 12.7% of those without PCOS (p=0.001). Insulin resistance was the most frequent individual metabolic abnormality and was significantly associated with PCOS (45.2% vs. 14.3%, p<0.001). Central obesity was also significantly more common among women with PCOS (45.2% vs. 15.9%, p=0.001) (*Table VII*).

Table VII
Distribution of metabolic abnormalities according to PCOS status (*n*=105).

Metabolic abnormality	PCOS (n=42)	No PCOS (n=63)	Total (n=105)	p-value*
Insulin resistance	19 (45.2%)	9 (14.3%)	28 (26.7%)	<0.001
Impaired glucose tolerance	9 (21.4%)	5 (7.9%)	14 (13.3%)	0.049
Dyslipidemia	21 (50.0%)	17 (27.0%)	38 (36.2%)	0.019
Central obesity	19 (45.2%)	10 (15.9%)	29 (27.6%)	0.001
≥1 metabolic abnormality	29 (69.0%)	23 (36.5%)	52 (49.5%)	0.001
≥2 metabolic abnormalities	17 (40.5%)	8 (12.7%)	25 (23.8%)	0.001

** Chi-square test.*

PCOS was significantly more frequent among women with severe acne than among those with moderate acne (51.2% vs. 32.3%, p=0.049). Severe acne was also associated with higher frequencies of hirsutism (46.5% vs. 25.8%, p=0.034), menstrual irregularity (48.8% vs. 27.4%, p=0.025), insulin resistance (37.2% vs. 19.4%, p=0.045) and central obesity (39.5% vs. 19.4%, p=0.027). Although metabolic abnormalities overall were more frequent among women with severe acne (60.5% vs. 41.9%), this difference was not statistically significant (*p*=0.061) (*Table VIII*).

Table VIII
Association between acne severity and PCOS/metabolic abnormalities (n=105).

Variable	Moderate acne (n=62)	Severe acne (n=43)	p-value*
PCOS present	20 (32.3%)	22 (51.2%)	0.049
Hirsutism	16 (25.8%)	20 (46.5%)	0.034
Irregular menstruation	17 (27.4%)	21 (48.8%)	0.025
Elevated testosterone	14 (22.6%)	17 (39.5%)	0.057
Insulin resistance	12 (19.4%)	16 (37.2%)	0.045
Central obesity	12 (19.4%)	17 (39.5%)	0.027
≥1 metabolic abnormality	26 (41.9%)	26 (60.5%)	0.061

** Chi-square test.*

DISCUSSION

The present study included 105 women with moderate-to-severe acne, with a mean age of 26.1±4.7 years; 45.7% were aged 18–24 years, 32.4% were 25–29 years, and 21.9% were 30–35 years. Urban women constituted 68.6%. In contrast, Chanyachailert et al. studied 208 adult women with acne aged ≥25 years and reported a mean age of 31.8±7.1 years, with 47.1% having persistent acne, 26.9% late-onset acne, and 26.0% recurrent acne [7]. Regarding clinical characteristics, 59.0% of the present participants had moderate acne and 41.0% had severe acne. Kartal et al., in a prospective study of women with acne, found 42% moderate, 30% severe and 28% very severe acne [11]. Premenstrual exacerbation occurred in 54.3% of our participants, compared with 72.6% in Chanyachailert et al., while hirsutism occurred in 34.3% in the current study [7]. Alan and Cenesizoglu also found increased frequencies of hirsutism and menstrual irregularity among women with acne and demonstrated positive relationships between androgen levels, BMI and acne severity [12]. Menstrual abnormalities were present in 36.2% of the current participants, including oligomenorrhea in 29.5% and amenorrhea in 6.7%. Chanyachailert et al. identified irregular menstruation as an important factor associated with PCOS among adult women with acne, while their study also found premenstrual flare in 72.6% [7]. The biochemical findings demonstrated an important metabolic burden: insulin resistance was present in 26.7%, elevated testosterone in 29.5%, elevated LDL-C in 21.0%, elevated triglycerides in 20.0%, low HDL-C in 23.8%, and impaired glucose tolerance in 13.3%. Another study reported that even non-obese women with PCOS had markedly increased risks of insulin resistance (OR 5.70), impaired glucose tolerance (OR 3.42), hypertriglyceridemia (OR 10.46) and low HDL-C (OR 4.03) compared with non-obese controls [5]. In Bangladesh, Islam et al. found central obesity in 81.4%, abnormal glucose tolerance in 47.1%, dyslipidemia in 45.7%, hirsutism in 88.6% and acanthosis nigricans in 50% among women with PCOS [13]. PCOS was diagnosed in 40.0% of the present participants. Chanyachailert et al. reported PCOS in 48.1% of 208 adult women with acne [7]. More recently, Jesmin et al., in a 2025 Bangladeshi study of 136 women with acne, reported a PCOS frequency of 36.8%; women with PCOS had higher frequencies of hirsutism (88.0%), obesity (42.0%), acanthosis nigricans (66.0%) and menstrual disturbances (62.0%) [14]. The contrast between PCOS and non-PCOS groups was particularly important. Women with PCOS had higher BMI (25.1±4.1 vs 22.8±3.3 kg/m², p=0.002), larger waist circumference (83.1±9.7 vs 76.9±8.1 cm, p=0.001), and substantially higher frequencies of irregular menstruation (69.0% vs 14.3%), hirsutism (59.5% vs 17.5%), acanthosis nigricans (31.0% vs 7.9%), elevated testosterone (52.4% vs 14.3%) and insulin resistance (45.2% vs 14.3%), all with significant statistical associations except some lipid variables. These findings fit the phenotype reported by Kamrul-Hasan et al. in 175 Bangladeshi adolescents with PCOS, where 94.9% had hirsutism, 69.1% were overweight/obese, 65.7% had abdominal obesity, 90.9% had dyslipidemia, and 42.3% had metabolic syndrome [15]. Metabolic abnormalities were present in 69.0% of women with PCOS versus 36.5% without PCOS, while two or more abnormalities occurred in 40.5% versus 12.7%, respectively. Lim et al., in a meta-analysis of 59 studies, found that women with PCOS had 3.35-fold greater odds of metabolic syndrome, with obesity, waist circumference, triglycerides, HDL-C, glucose tolerance and HOMA-IR contributing significantly to metabolic heterogeneity [4]. Wekker et al. further reported increased risks of type 2 diabetes (5.9% vs 2.0%; RR 3.00) and hypertension (RR 1.75) in women with PCOS [3]. Finally, severe acne was associated with higher frequencies of PCOS (51.2% vs 32.3%, p=0.049), hirsutism (46.5% vs 25.8%, p=0.034), menstrual irregularity (48.8% vs 27.4%, p=0.025), insulin resistance (37.2% vs 19.4%, p=0.045) and central obesity (39.5% vs 19.4%, p=0.027). Alan and Cenesizoglu similarly demonstrated a positive correlation between BMI and acne severity and reported higher total and free testosterone among women with acne [12]. The findings therefore suggest that increasing acne severity may identify a subgroup with greater androgenic and metabolic vulnerability. This is clinically relevant because the 2023 international PCOS guideline recommends glycaemic assessment at diagnosis and recognizes increased glucose intolerance and diabetes risk irrespective of age or BMI [1].

LIMITATIONS

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

The study demonstrated a high burden of PCOS and metabolic dysfunction among women with moderate-to-severe acne, with PCOS detected in 40.0% of participants. PCOS was significantly associated with menstrual irregularity, hirsutism, acanthosis nigricans, higher BMI and waist circumference, hyperandrogenemia, insulin resistance, and dyslipidemia, while severe acne showed a significantly higher frequency of PCOS, insulin resistance, and central obesity.

RECOMMENDATION

Women presenting with moderate-to-severe acne should be screened selectively for PCOS, particularly when accompanied by menstrual irregularity, hirsutism, obesity, or acanthosis nigricans. Assessment of BMI, waist circumference, glucose status, lipid profile, and androgen excess should be considered in clinically suspected cases, with appropriate gynecological or endocrinological referral for women with suggestive findings.

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CONFLICT OF INTEREST

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