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Original Article

Frequency of androgenic alopecia in patients presenting with polycystic ovarian syndrome at tertiary care hospital Karachi

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Abstract

Background Polycystic ovary syndrome (PCOS) is a multifactorial endocrine disorder characterized by hyperandrogenism, anovulation, and polycystic ovarian morphology. Dermatological manifestations of hyperandrogenism include acne, hirsutism, and androgenic alopecia, also known as female pattern hair loss (FPHL). While FPHL has significant psychosocial implications, it may also reflect underlying metabolic dysfunction. Despite the high burden of PCOS in South Asia, local epidemiological data on androgenic alopecia in PCOS remain scarce.

Objective To determine the frequency of androgenic alopecia in women with PCOS presenting to a tertiary care hospital in Karachi and to evaluate its association with clinical and metabolic parameters.

Methods Patients with confirmed diagnosis of PCOS according to Rotterdam criteria and hair loss for more than one month were included. Clinical diagnosis of androgenic alopecia was made through detailed dermatological examination of the scalp by a consultant dermatologist. The severity and pattern of hair loss were graded using the Ludwig classification and the Sinclair scale for female pattern hair loss.

Results Among 135 participants, 112 (83%) had androgenic alopecia. Significant associations were observed with age >30 years (p=0.024), hirsutism (OR 2.0, 95% CI 1.1-3.9), sleep disturbance (OR 1.9, 95% CI 1.1-3.4), and smoking (OR 1.9, 95% CI 1.0-3.9). Elevated LDL was an independent predictor, while serum androgen levels showed no significant correlation.

Conclusion Androgenic alopecia is highly prevalent among women with PCOS and is significantly associated with age >30 years, hirsutism, sleep disturbance, smoking, and elevated LDL cholesterol. Dermatological evaluation may help identify associated clinical and metabolic abnormalities in these patients.

Keywords Polycystic Ovary Syndrome; Alopecia; Hyperandrogenism; Insulin Resistance; Prevalence.

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Introduction

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders among women of reproductive age, with a frequency ranging from 6% to 20% globally depending on the diagnostic criteria used.[1,2] In Pakistan, several studies have shown prevalence between 17% and 26%, highlighting the syndrome as an important public health issue.[3,4] The condition is characterized by oligo- or anovulation, clinical or biochemical hyperandrogenism, and polycystic ovarian morphology, and is associated with both reproductive and metabolic complications.[5]

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Among the cutaneous features of hyperandrogenism in PCOS are acne, hirsutism, and androgenic alopecia. Female pattern hair loss (FPHL), the clinical presentation of androgenic alopecia in women, typically manifests as diffuse thinning of scalp hair over the mid-frontal and parietal regions with preservation of the frontal hairline.[6] It is considered a distressing manifestation, often associated with reduced quality of life and psychosocial difficulties. Furthermore, dermatological features of PCOS may serve as visible markers for underlying systemic dysfunction, drawing early clinical attention to metabolic risk factors such as obesity, dyslipidemia, and insulin resistance.[7,8]

Despite the high burden of PCOS in Pakistan, limited epidemiological data exist regarding the frequency of androgenic alopecia among affected women. Most local studies have focused on reproductive, endocrine, or metabolic consequences, while dermatological manifestations remain underreported.[9,10] Previous international studies have reported that androgenic alopecia occurs in approximately 30-50% of women with PCOS, although the prevalence varies depending on population characteristics and diagnostic criteria.[6,9] However, data regarding the frequency of androgenic alopecia among Pakistani women with PCOS remain limited. Establishing the frequency of androgenic alopecia in this population may facilitate timely diagnosis, improve patient counseling, and provide opportunities for early intervention. This study was therefore designed to determine the frequency of androgenic alopecia in women with PCOS presenting at a tertiary care hospital in Karachi and to examine its association with demographic, clinical, and metabolic parameters.

Methods

This cross-sectional study was conducted at the Department of Dermatology, PNS Shifa Hospital, Karachi, from October 2021 to May 2022 after obtaining ethical approval from PNS Shifa, Karachi vide letter No. ERC/2023/DERMA/10 dated 01.10.2021. Written informed consent was taken from all participants before enrollment.

The sample size was calculated using the WHO sample size calculator, assuming a prevalence of androgenic alopecia among women with PCOS of 50%, a confidence level of 95%, and a margin of error of 8%. The calculated sample size was 151 participants. However, due to the study duration and eligibility criteria, 135 participants were finally included in the study.

A total of 135 women aged between 20-60 years with a confirmed diagnosis of PCOS, based on the Rotterdam 2003 criteria, presenting with hair loss for more than one month were included through non-probability consecutive sampling. Exclusion criteria were patients with anemia, alopecia areata, scarring alopecia, telogen effluvium, thyroid disorders, or a history of corticosteroid or hormone therapy within the past three months.

Clinical diagnosis of androgenic alopecia was established through detailed dermatological examination of the scalp, and the severity of hair loss was graded using the Ludwig and Sinclair classification scales under the supervision of a senior dermatologist. Demographic details, BMI, residence status, and clinical symptoms were recorded on a structured proforma. BMI was calculated using weight in kilograms divided by height in meters squared (kg/m²). Hirsutism was assessed using the modified Ferriman-Gallwey (mFG) scoring system, with a score ≥8 considered diagnostic of hirsutism.

Laboratory evaluation included measurement of serum androgen levels and lipid profile parameters, including LDL cholesterol, HDL cholesterol, triglycerides, and total cholesterol.

Data were analyzed using SPSS Version 22. Descriptive statistics were applied with mean±SD for continuous variables and frequencies/ percentages for categorical variables. Chi-square test was used to assess associations between categorical variables. Fisher's exact test was applied where the

expected cell frequency was less than 5. Logistic regression analysis was performed to identify independent predictors. A p-value <0.05 was considered statistically significant.

Results

A total of 135 women with PCOS presenting with hair loss were included in the study. The mean age of participants was 42.8±15.1 years, and the mean BMI was 29.7±3.9 kg/m². Among them, 79 (58.5%) were older than 30 years, while 56 (41.5%) were aged ≤30 years. Baseline demographic and clinical characteristics of the study population are presented in **Table 1**.

Out of the 135 participants, 112(83.0%) were diagnosed with androgenic alopecia, while 23(17.0%) had other causes of hair loss.

On bivariate analysis, androgenic alopecia was significantly more common in women aged >30 years (73/112, 65.2%) compared with younger women (6/23, 26.1%) (OR 2.3, 95% CI 1.1-4.7; p=.024). Hirsutism was also significantly associated with alopecia (58/112, 51.8% vs. 6/23, 26.1%) (OR 2.0, 95% CI 1.1-3.9; p=.031). Sleep disturbance was reported in 47/112 (42.0%) women with alopecia compared with 5/23 (21.7%) without alopecia (OR 1.9, 95% CI 1.1-3.4; p=.041). Smoking was more common among women with alopecia (26/112, 23.2%) compared with 2/23 (8.7%) (OR 1.9, 95% CI 1.0-3.9; *p*=0.048). BMI categories and residence status were also analyzed; however, no statistically significant association with androgenic alopecia was observed (p>0.05). The frequencies and statistical comparisons are presented in **Table 2**. Dyslipidemia was more prevalent among women with androgenic alopecia. On multivariate logistic regression analysis, elevated LDL cholesterol remained an independent predictor of androgenic alopecia (adjusted OR 2.3, 95% CI 1.2-4.1; p=.016) after adjusting for age, hirsutism, and lifestyle factors. Other lipid parameters and fasting glucose levels did not show statistically significant associations. The results of the multivariate logistic regression analysis are summarized in **Table 3**.

These findings highlight that while classical biochemical markers may not always correlate with alopecia, metabolic abnormalities such as elevated LDL have a stronger predictive value and may warrant early intervention in PCOS patients presenting with hair loss.

BMI was calculated as weight in kilograms divided

Table 1 Baseline demographic and clinical characteristics of women with PCOS presenting with hair loss (n = 135)

Variable	*Mean ± SD / n (%)*
Age (years)	42.8±15.1
BMI (kg/m²)	29.7±3.9
Age group ≤30 years	56 (41.5)
Age group >30 years	79 (58.5)
Hirsutism present	64 (47.4)
Sleep disturbance	52 (38.5)
Smoking	28 (20.7)
Androgenic alopecia	112 (83.0)
No alopecia	23 (17.0)

Table 2 Association between clinical variables and androgenic alopecia in women with PCOS

Variable	*With alopecia (n=112)*	*Without alopecia (n=23)*	*OR (95% CI)*	*p-value*
Age >30 years	73 (65.2)	6 (26.1)	2.3 (1.1-4.7)	.024
Hirsutism	58 (51.8)	6 (26.1)	2.0 (1.1-3.9)	.031
Sleep disturbance	47 (42.0)	5 (21.7)	1.9 (1.1-3.4)	.041
Smoking	26 (23.2)	2 (8.7)	1.9 (1.0-3.9)	.048
BMI ≥30	40 (35.7)	7 (30.4)	1.27 (0.48-3.34)	0.61
Urban Residence	36 (32.1)	12 (52.2)	0.43 (0.18-1.05)	0.13

Note: Chi-square test applied; Fisher's exact test used where appropriate.

Table 3 Multivariate logistic regression analysis for predictors of androgenic alopecia.

Variable	*Unadjusted OR (95% CI)*	*Adjusted OR (95% CI)*	*p-value*
Age >30 years	2.3 (1.1-4.7)	2.1 (1.0-4.3)	.038
Hirsutism	2.0 (1.1-3.9)	1.8 (1.0-3.5)	.049
Sleep disturbance	1.9 (1.1-3.4)	1.7 (0.9-3.3)	.072
Smoking	1.9 (1.0-3.9)	1.5 (0.8-3.0)	.110
Elevated LDL	-	2.3 (1.2-4.1)	.016

by height in meters squared (kg/m²). BMI ≥25 kg/m² was considered overweight and ≥30 kg/m² as obesity.

LDL cholesterol level >130 mg/dL was considered elevated. Hirsutism was defined as a modified Ferriman-Gallwey (mFG) score ≥8.

Discussion

In our study, a high prevalence of androgenic alopecia (83%) was observed among women with PCOS. This rate is considerably higher than the prevalence reported in international literature. For instance, Singh *et al*. reported a lower prevalence of female pattern hair loss in Indian women with PCOS,[9] while Starace *et al*. described a prevalence closer to 40% in European cohorts.[6] Özkoca *et al*. further demonstrated that demographic and comorbidity differences among FPHL subtypes may influence prevalence across populations.[14] Such variation highlights the possible influence of ethnicity, genetics, and lifestyle factors on disease expression.

Age was significantly associated with alopecia in our study, with women above 30 years more frequently affected. Similar findings have been described by Bienenfeld *et al*; who noted that progressive follicular miniaturization increases with age.[5] Starace *et al*. also emphasized age as a key determinant of female pattern hair loss severity.[6] However, in contrast, Arif *et al*. did not find age to be a major factor in their cohort of Pakistani women,[10] suggesting that regional differences in lifestyle and reproductive health may modulate risk.

We also observed that hirsutism was strongly associated with alopecia. Verma *et al*. demonstrated a similar relationship, reporting that women with hirsutism had higher rates of alopecia.[17] Locally, Naeem *et al*. confirmed that clinical markers of hyperandrogenism, such as hirsutism and alopecia, are common in PCOS women.[12] Our findings strengthen the argument that dermatological signs may be more sensitive indicators of androgen excess than biochemical markers alone.

Lifestyle variables, including sleep disturbance and smoking, were significantly associated with alopecia in bivariate analysis. Qiu *et al*. in their meta-analysis highlighted that lifestyle-related stressors contribute to the worsening of androgenetic alopecia.[7] Leszyńska *et al*. also reported that comorbidities linked to unhealthy lifestyle, such as obesity and metabolic syndrome, were common in women with alopecia.[15] Although these factors were attenuated in our multivariate analysis, they remain clinically important and suggest a need for holistic lifestyle interventions in PCOS management.

A particularly important finding of our study was the independent association between elevated LDL cholesterol and androgenic alopecia (female pattern hair loss). Reddy *et al*. found a similar link, reporting that dyslipidemia was significantly higher in women with alopecia.[13] Leszyńska *et al*. also confirmed that female pattern hair loss correlates with metabolic syndrome and lipid abnormalities.[15] In contrast, Carmina *et al*. did not observe a strong role of serum androgens in predicting alopecia,[11] which aligns with our observation that biochemical androgen levels were not significantly related to hair loss. Together, these findings suggest that metabolic dysregulation, rather than circulating androgens alone, may drive alopecia in PCOS.

The psychosocial impact of alopecia also deserves emphasis. Mohamed *et al*. reported that women with alopecia suffer significant psychological distress and reduced quality of life.[21] Hwang *et al*. observed similar findings in Korean women, noting impaired self-esteem and social functioning.[23] A local study by Shilpashree *et al*. likewise documented marked reductions in quality of life in Pakistani women with female pattern hair loss.[24] These reports highlight that alopecia in women may have significant psychosocial implications and should be considered not only a cosmetic concern but also a condition affecting overall well-being.

The strengths of our study include the use of

standardized diagnostic criteria (Rotterdam criteria for PCOS and Ludwig/Sinclair grading systems for androgenic alopecia) and systematic assessment of both clinical and metabolic parameters including LDL cholesterol and lipid profile components. However, it was limited by its single-center design, relatively modest sample size, and reliance on clinical rather than histopathological confirmation. Hussain *et al*. in a recent local study also emphasized the importance of dermatological manifestations in PCOS and recommended larger, multicenter studies to confirm these associations.[25]

Conclusion

The study confirms a strong association between PCOS and female pattern hair loss.

Routine screening and early dermatological evaluation should be encouraged in PCOS patients to identify hair loss at early stages and address associated metabolic risks.

In conclusion, androgenic alopecia is a frequent and clinically significant manifestation of PCOS in Pakistani women. It showed significant association with clinical factors including age >30 years, hirsutism, sleep disturbance, and smoking, while elevated LDL cholesterol emerged as an independent metabolic predictor. These findings highlight the importance of dermatological evaluation in women with PCOS.

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

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Author's contribution

FH: Substantial contribution to conception and design of the study. Acquisition, analysis and interpretation of data. Drafting and revising the manuscript critically for important intellectual content.

NA,TM: Contribution to conception and design, analysis and interpretation of data. Revising the manuscript critically for importatnt intellectual content.

UM,UA: Contribution to conception and design, analysis and interpretation of data. Drafting the manuscript.

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