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Phenotypic Spectrum, Menstrual Irregularity, and Reproductive Outcomes Among Women with PCOS Attending Public Hospitals in Gujranwala: A - Participant Cross-Sectional Study

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ABSTRACT

Background: Polycystic Ovary Syndrome (PCOS) is a prevalent endocrine disorder affecting women of reproductive age and is characterized by menstrual irregularities, hyperandrogenism, and polycystic ovarian morphology. It contributes substantially to infertility, metabolic dysfunction, and psychological morbidity, particularly in South Asian populations where lifestyle and genetic factors may amplify disease expression. Objective: This study aimed to evaluate the clinical, hormonal, and reproductive characteristics of women with PCOS in Gujranwala, Pakistan, and to identify phenotypic predictors of infertility. Methods: A cross-sectional analysis was conducted among 500 women aged 18–44 years, diagnosed using Rotterdam criteria. Demographic, menstrual, and clinical data were collected through structured interviews. Hormonal assays measured LH, FSH, and testosterone levels, while ultrasound confirmed ovarian morphology. Multivariable logistic regression identified independent predictors of infertility. Statistical analysis was performed using SPSS v26, with significance set at $p < 0.05$. Results: The mean age was 28.3 ± 6.5 years. Oligomenorrhea (76%), acne (58.6%), and hirsutism (53.6%) were predominant features. Infertility affected 67.8% of participants. Independent predictors included oligomenorrhea (aOR 3.84, $p < 0.001$), elevated testosterone (aOR 2.67, $p = 0.001$), obesity (aOR 1.92, $p = 0.017$), and ultrasound-confirmed PCOS (aOR 2.43, $p = 0.006$). Depression was reported in 74.8% of women. Conclusion: PCOS in Pakistani women presents with severe reproductive and psychological manifestations. Early detection, lifestyle interventions, and integrated psychosocial care are essential to mitigate infertility and metabolic complications.

Keywords
Polycystic Ovary Syndrome; Infertility; Hyperandrogenism; Oligomenorrhea; Obesity; Depression; Pakistan.

INTRODUCTION

Polycystic Ovary Syndrome (PCOS) is a multifactorial endocrine disorder that affects women of reproductive age and represents a major global reproductive health challenge. It is characterized by hyperandrogenism, oligo-anovulation, and polycystic ovarian morphology, as defined by the Rotterdam criteria (ESHRE/ASRM, 2003). The syndrome manifests heterogeneously, with phenotypic variations ranging from menstrual irregularities and acne to obesity, infertility, and metabolic complications. Despite its high prevalence, the etiology and pathophysiology of PCOS remain incompletely understood, involving complex interactions between genetic, hormonal, and environmental factors (Dumesic et al., 2015; De Leo et al., 2016).

Globally, PCOS prevalence estimates vary from 4% to 21%, depending on diagnostic criteria, population, and ethnicity (March et al., 2010; Yildiz et al., 2012). South Asian populations, including Pakistan, appear disproportionately affected, with prevalence rates reported as high as 20–22% among reproductive-age women (Barnard et al., 2007). Environmental exposures, dietary habits, and patterns of self-medication further modulate disease expression in these populations. The high rates of consanguinity in regions such as Gujranwala, Pakistan, may additionally contribute to familial clustering and genetic predisposition.

Clinically, PCOS contributes significantly to reproductive morbidity. It is the leading cause of anovulatory infertility and is associated with long-term risks including insulin resistance, dyslipidemia, type 2 diabetes, cardiovascular disease, and psychological distress (Teede et al., 2010; Cooney et al., 2017). Beyond metabolic consequences, PCOS adversely affects quality of life through its dermatologic and reproductive manifestations, particularly acne, hirsutism, menstrual irregularity, and infertility (Dokras et al., 2016).

Despite increasing recognition, few large-scale epidemiologic studies from Pakistan have comprehensively characterized the phenotypic spectrum and reproductive outcomes of PCOS in clinical populations. In Gujranwala and similar districts, variable environmental exposures, cultural practices, and dietary patterns may influence PCOS expression, yet systematic data remain limited. Moreover, the overlap of hormonal, metabolic, and psychosocial features complicates timely diagnosis and management.

This study aims to delineate the phenotypic spectrum, menstrual irregularity, and reproductive outcomes among women with PCOS attending two major public hospitals in Gujranwala. By analyzing 500 clinically confirmed cases, we seek to:

Describe demographic, clinical, and biochemical characteristics of PCOS patients.
Examine the association between key phenotypic features (oligomenorrhea, acne, testosterone levels, BMI, and ultrasound findings) and infertility.
This clinic-based dataset provides an opportunity to identify major correlates of infertility and to inform early detection, targeted counseling, and health service planning for women affected by PCOS in Pakistan.

MATERIALS AND METHODS

This analytical cross-sectional study was designed to investigate the clinical, biochemical, and reproductive characteristics of women diagnosed with Polycystic Ovary Syndrome (PCOS) and to identify phenotypic predictors of infertility within a clinic-based cohort in Gujranwala, Pakistan. The study rationale was grounded in the need to provide population-specific epidemiological data and to explore the association between hormonal, metabolic, and reproductive parameters in women with PCOS attending public health facilities.
The study was conducted at two major public sector hospitals—the Social Security Hospital and the District Headquarter Hospital, Gujranwala—serving a diverse urban and peri-urban population. Data were collected prospectively over a defined 18-month period, from January 2022 to June 2023. These hospitals were selected because they represent the primary referral centers for gynecological and endocrinological conditions in the region, thus ensuring an adequate capture of the clinical spectrum of PCOS in women from different socioeconomic and environmental backgrounds.
Participants were recruited consecutively from the gynecology outpatient departments. Women aged 18 to 44 years, of reproductive age, who fulfilled the Rotterdam diagnostic criteria for PCOS—defined by the presence of at least two of the following: (i) oligo- or anovulation, (ii) clinical or biochemical hyperandrogenism, and (iii) polycystic ovarian morphology on ultrasound—were eligible for inclusion (34,35). Exclusion criteria included pregnancy, current lactation, thyroid dysfunction, Cushing's syndrome, congenital adrenal hyperplasia, or use of hormonal medication within the preceding three months. Eligible women were informed about the study objectives, procedures, and confidentiality safeguards. Written informed consent was obtained from all participants before enrollment.
A structured data sheet was used for primary data collection, developed based on previously validated instruments and adapted for local context. It recorded demographic details (age, education, marital status, occupation, socioeconomic class, area of residence), reproductive and menstrual history (age at menarche, cycle regularity, oligomenorrhea, infertility history, parity), lifestyle factors (dietary habits, physical activity), and family history of endocrine or metabolic disorders. Clinical assessments included anthropometric measurements—height, weight, and body mass index (BMI)—as well as evaluation of acne and hirsutism patterns using the modified Ferriman-Gallwey score. Blood pressure and allied comorbidities such as hypertension and diabetes were also documented.
Venous blood samples were collected in the early follicular phase (day 2–5 of the menstrual cycle) or at random for amenorrheic women, after a 12-hour overnight fast. Serum levels of luteinizing hormone (LH), follicle-stimulating hormone (FSH), and total testosterone were measured using enzyme-linked immunosorbent assays. The LH/FSH ratio was calculated where both values were available. Pelvic ultrasound examinations were performed using a standardized transabdominal or transvaginal probe, and polycystic ovarian morphology was defined as the presence of ≥12 follicles measuring 2–9 mm in diameter and/or an ovarian volume >10 cm^3 in either ovary.
To minimize selection and information bias, all interviews and clinical measurements were conducted by trained investigators using standardized protocols. Laboratory assays were performed at the same diagnostic laboratory with internal quality control procedures. Cross-checking of data entries and double-verification of 10% of randomly selected records were conducted to ensure consistency and accuracy. The study adopted consecutive sampling to reduce referral bias. Confounding factors such as age and BMI were accounted for during statistical analysis.
The sample size of 500 participants was based on an anticipated PCOS prevalence of 20% among reproductive-aged women in Pakistan (31), with a 95% confidence interval and 4% precision, and was further inflated by 10% to account for incomplete records.
Data were coded and analyzed using IBM SPSS Statistics version 26. Descriptive statistics (mean, standard deviation, and percentages) were used to summarize continuous and categorical variables. Normality of distributions was assessed using the Kolmogorov–Smirnov test. Comparisons between groups were made using Student's t-test or Mann–Whitney U test for continuous variables and Chi-square test for categorical variables. Multivariable logistic regression modeling was employed to identify independent predictors of infertility, with infertility (yes/no) as the dependent variable and oligomenorrhea, acne, BMI category, testosterone levels, ultrasound-confirmed PCOS, and depression as covariates. Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were reported. Multicollinearity was checked using variance inflation factors (VIF < 2.0 as acceptable). Missing data for key variables were <5% and handled by complete-case analysis. Subgroup analyses stratified participants by age (18–26, 27–34, and 35–44 years) and BMI (normal, overweight, obese) to explore differential associations.
Ethical approval was obtained from the Institutional Review Board of the University of the Punjab (Reference No. PU-EB/21/2022), and the study adhered to the ethical principles of the Declaration of Helsinki (2013 revision). All participants provided written informed consent prior to participation. Data confidentiality was maintained through de-identification and secure storage of electronic and paper records accessible only to authorized investigators.
Reproducibility and data integrity were ensured through the use of pretested instruments, standardized measurement protocols, and transparent documentation of analytical procedures. All datasets, coding frameworks, and analysis scripts were retained in a secure repository for potential secondary verification and replication.

RESULTS

A total of 500 women diagnosed with polycystic ovary syndrome (PCOS) were enrolled in this cross-sectional study conducted at public hospitals in Gujranwala. The mean age of participants was 28.3 ± 6.5 years, ranging from 18 to 44 years. The majority of women (47.8%) were between 27 and 34 years of age, followed by 32.6% aged 18–26 years and 19.6% aged 35–44 years. Most participants resided in urban areas (52.4%), while 47.6% were from rural settings. A considerable proportion (53.8%) belonged to the middle socioeconomic class, whereas 35.2% were upper-class and 11% were from lower-income backgrounds. The relationship between socioeconomic class and PCOS occurrence was statistically significant ($p < 0.001$), indicating a higher burden among middle- and upper-class women.
In terms of marital status, 72% (n = 360) of participants were married, and 28% (n = 140) were unmarried, showing that PCOS is prevalent in both reproductive and pre-reproductive age groups ($p < 0.001$). Regarding education, nearly one-third (30.8%) had education up to matriculation,

another 30.2% had completed intermediate, and 39% held graduate or postgraduate degrees (p = 0.018). Employment status analysis revealed that 60.8% were housewives, while 39.2% were either students or employed (p = 0.041). Dietary assessment showed that the most common dietary habit among participants was chicken consumption (31.0%), followed by mixed diets (30.0%), vegetarian diets (21.4%), and meat-only diets (17.6%), though the association between diet and PCOS was not statistically significant (p = 0.056).

Table 1. Demographic and Socioclinical Characteristics of Women with PCOS (n = 500)

Variable	Category	n (%)	Mean ± SD	p-value*
Age (years)	18–26	163 (32.6)		0.072
	27–34	239 (47.8)		
	35–44	98 (19.6)		
Residence	Urban	262 (52.4)		0.311
	Rural	238 (47.6)		
Socioeconomic class	Lower	55 (11.0)		<0.001
	Middle	269 (53.8)		
	Upper	176 (35.2)		
Marital status	Married	360 (72.0)		<0.001
	Unmarried	140 (28.0)		
Occupation	Employed/student	196 (39.2)		0.041
	Housewife	304 (60.8)		
Education	≤Matric	154 (30.8)		0.018
	Intermediate	151 (30.2)		
	≥Graduate	195 (39.0)		
Area diet pattern	Chicken-only	155 (31.0)		0.056
	Mixed	150 (30.0)		
	Vegetarian	107 (21.4)		
	Meat-only	88 (17.6)		

*p-values represent comparisons across categories using Chi-square or ANOVA, where appropriate. The largest demographic group comprised urban, middle-class women (53.8%), aged 27–34 years (47.8%).

Table 2. Reproductive and Menstrual Attributes of PCOS Participants

Variable	Category	n (%)	Mean ± SD	p-value
Age at menarche (years)	10–11	76 (15.2)	12.9 ± 1.2	0.261
	12–13	201 (40.2)		
	14–16	223 (44.6)		
Menstrual cycle	Regular	120 (24.0)		<0.001
	Irregular (oligomenorrhea/amenorrhea)	380 (76.0)		
Infertility status	Yes	339 (67.8)		<0.001
	No	161 (32.2)		
Ultrasound-confirmed PCOS	Yes	406 (81.2)		<0.001
	No	94 (18.8)		
Number of children	0	392 (78.4)		
	1–2	105 (21.0)		
	≥3	3 (0.6)		

Irregular menstruation was present in 76% of participants, while 81.2% showed sonographic evidence of polycystic ovarian morphology.

Table 3. Hormonal Profile of PCOS Participants

Parameter	Category (nmol/L)	n (%)	Mean ± SD	p-value
Testosterone	30–49.9	29 (5.8)	64.5 ± 16.7	<0.001
	50–69.9	360 (72.0)		
	≥70	111 (22.2)		
FSH	1–2.9	63 (12.6)	6.2 ± 3.5	0.047
	3–5.9	193 (38.6)		
	6–9.9	107 (21.4)		
	≥10	137 (27.4)		
LH/FSH > 2	Elevated	178 (35.6)		0.012
	Normal	322 (64.4)		

The majority (72%) had testosterone levels between 50–69.9 nmol/L, consistent with biochemical hyperandrogenism. Elevated LH/FSH ratios were observed in 35.6%, correlating with infertility (p = 0.012).

Table 4. Clinical and Dermatologic Features Associated with PCOS

Feature	Present n (%)	Absent n (%)	p-value
Acne	293 (58.6)	207 (41.4)	0.016
Hirsutism (≥ mFG 8)	268 (53.6)	232 (46.4)	0.024
Obesity	138 (27.6)	—	<0.001
Overweight	335 (67.0)	—	
Normal BMI	27 (5.4)	—	
Depression	374 (74.8)	126 (25.2)	<0.001
Headache	204 (40.8)	296 (59.2)	0.033
Abdominal bloating	184 (36.8)	316 (63.2)	0.048

Among clinical features, acne (58.6%), hirsutism (53.6%), and depression (74.8%) were highly prevalent. Depression showed significant association with both obesity and infertility ($p < 0.001$).

Table 5. Familial and Genetic Associations

Variable	Category	n (%)	Odds Ratio (95% CI)	p-value
Family history of PCOS	Yes	146 (29.2)	2.11 (1.45–3.08)	<0.001
Parental consanguinity	First cousin	172 (34.4)	1.89 (1.23–2.88)	0.004
	Second cousin	153 (30.6)	1.41 (0.96–2.10)	0.078
	Distant/unrelated	175 (35.0)	Ref	
Marital consanguinity (H/W)	Yes	181 (36.4)	1.22 (0.83–1.81)	0.231

Consanguinity among parents was present in 65% of families, with first-cousin relationships significantly associated with PCOS occurrence (OR = 1.89, 95% CI: 1.23–2.88, $p = 0.004$).

Table 6. Predictors of Infertility Among PCOS Participants (Multivariable Logistic Regression)

Predictor Variable	OR	95% CI	p-value
Oligomenorrhea	3.84	2.35–6.27	<0.001
Elevated Testosterone (≥ 70 nmol/L)	2.67	1.51–4.71	0.001
Obesity (BMI ≥ 30 kg/m²)	1.92	1.12–3.28	0.017
Ultrasound-confirmed PCOS	2.43	1.29–4.59	0.006
Depression	1.78	1.05–3.03	0.033
Age (per year increase)	0.94	0.89–0.99	0.028
Constant	—	—	—

The multivariable model identified oligomenorrhea, elevated testosterone, obesity, and ultrasound-confirmed PCOS as independent predictors of infertility ($p < 0.01$ for all). Each one-year increase in age slightly reduced the odds of infertility (aOR = 0.94, $p = 0.028$). Model fit was satisfactory (Hosmer–Lemeshow $p = 0.46$; Nagelkerke $R^2 = 0.38$).

The mean age at menarche was 13.0 ± 1.2 years, with 27.8% of women attaining menarche at age 14, 24.8% at age 13, and 15.4% at age 12. Menstrual irregularities were extremely common, with 76% (n = 380) of participants reporting oligomenorrhea or amenorrhea, compared to 24% with regular cycles ($p < 0.001$). The average age at PCOS diagnosis was 23.4 years, and the most frequent diagnostic age band was 20–24 years (40.8%), followed by 25–29 years (25.2%) and 15–19 years (13.4%).

The reproductive outcomes were markedly affected in this cohort. Infertility was observed in 339 women (67.8%), whereas only 32.2% retained normal fertility ($p < 0.001$). Among infertile participants, 78.4% were nulliparous, 16.8% had one child, 4.2% had two children, and only 0.6% had three or more. Ultrasound-confirmed PCOS was detected in 406 women (81.2%), while 18.8% did not exhibit typical cystic morphology ($p < 0.001$). Hormonal analysis showed elevated serum testosterone levels in a substantial proportion of patients, consistent with biochemical hyperandrogenism. Most women (72%) had testosterone concentrations between 50–69.9 nmol/L, whereas 22.2% had levels ≥70 nmol/L and only 5.8% fell below 50 nmol/L ($p < 0.001$). The mean testosterone concentration was 64.5 ± 16.7 nmol/L. Follicle-stimulating hormone (FSH) values clustered primarily between 3.0–5.9 nmol/L (38.6%) and 6.0–9.9 nmol/L (21.4%), with a mean of 6.2 ± 3.5 nmol/L ($p = 0.047$). Elevated LH/FSH ratios (>2) were documented in 35.6% of patients, suggesting disordered gonadotropin regulation; this parameter correlated significantly with infertility ($p = 0.012$).

Dermatologic and metabolic manifestations were prominent. Acne was present in 58.6%, hirsutism in 53.6%, and clinical obesity in 27.6% of the study population, with an additional 67% being overweight and only 5.4% maintaining a normal BMI ($p < 0.001$). Notably, depression was reported by 74.8% of women, a finding strongly associated with both obesity and infertility ($p < 0.001$). Additional symptoms included headache (40.8%), abdominal bloating (36.8%), and menstrual cramps (43.2%), with all showing statistically significant associations ($p < 0.05$).

A strong familial pattern was observed. Family history of PCOS was documented in 29.2% of participants, conferring a two-fold increased risk (OR = 2.11, 95% CI: 1.45–3.08, $p < 0.001$). Parental consanguinity was prevalent in 65% of families, with first-cousin marriages showing a significant association with PCOS (OR = 1.89, 95% CI: 1.23–2.88, $p = 0.004$). Marital consanguinity between husband and wife was less frequent (36.4%) and did not show a statistically significant link ($p = 0.231$).

In the multivariable logistic regression model examining predictors of infertility (Table 6), oligomenorrhea emerged as the strongest independent determinant (adjusted OR = 3.84, 95% CI: 2.35–6.27, $p < 0.001$). Other significant predictors included elevated testosterone levels ≥70 nmol/L (aOR = 2.67, 95% CI: 1.51–4.71, $p = 0.001$), obesity (aOR = 1.92, 95% CI: 1.12–3.28, $p = 0.017$), and ultrasound-confirmed cystic ovaries (aOR = 2.43, 95% CI: 1.29–4.59, $p = 0.006$). Depression also demonstrated a modest but significant association with infertility (aOR = 1.78, 95% CI: 1.05–3.03, $p = 0.033$). Interestingly, age showed a small protective effect, with each additional year reducing infertility odds by approximately 6% (aOR = 0.94, $p = 0.028$). The model exhibited good calibration (Hosmer–Lemeshow $p = 0.46$) and explained 38% of the variance in infertility

status (Nagelkerke $R^2 = 0.38$). Overall, the results illustrate that PCOS in this Gujranwala cohort presents most commonly in women aged 20–34 years, residing in urban middle-class households, and characterized by a combination of menstrual irregularity, acne, hyperandrogenemia, and subfertility. The data reinforce the strong associations between metabolic dysfunction, obesity, and reproductive outcomes, while highlighting the psychosocial burden evidenced by a high prevalence of depressive symptoms.

DISCUSSION

This cross-sectional study provides an extensive clinical and biochemical characterization of women diagnosed with polycystic ovary syndrome (PCOS) in Gujranwala, Pakistan, highlighting both reproductive and metabolic aspects of the condition. The findings confirm PCOS as a highly prevalent and heterogeneous disorder with significant reproductive and psychosocial consequences. The predominance of oligomenorrhea, hyperandrogenism, and obesity observed in this cohort aligns with the established pathophysiologic framework of PCOS, which involves dysregulation of the hypothalamic–pituitary–ovarian axis, insulin resistance, and genetic susceptibility (36).

The mean age of affected women in this study (28.3 ± 6.5 years) is consistent with observations from other South Asian studies, where PCOS commonly manifests in the third decade of life (37). The high frequency of diagnosis between 20 and 24 years reflects increasing awareness and early clinical presentation, yet also emphasizes the reproductive-age vulnerability of this population. The predominance of urban and middle socioeconomic participants mirrors regional trends, as urban lifestyle patterns, sedentary behavior, and processed dietary habits are known to exacerbate insulin resistance and hyperandrogenism (38). Similar demographic distributions have been reported in Indian and Bangladeshi studies, where urbanization has been linked to higher PCOS prevalence (39).

Menstrual irregularity was the most prevalent symptom, affecting 76% of participants, consistent with earlier findings by Nidhi et al. (2011), who documented menstrual disturbances in 74% of Indian women with PCOS (40). Oligomenorrhea emerged as the strongest independent predictor of infertility in this study (aOR = 3.84, $p < 0.001$), confirming its direct relationship to anovulatory cycles and hormonal dysregulation. This finding corroborates the mechanistic basis proposed by Dumesic et al. (2015), where aberrant LH pulsatility and follicular arrest result in chronic anovulation (41).

The biochemical data reinforce the centrality of hyperandrogenism in the PCOS phenotype. Elevated testosterone was detected in 72% of participants, and women with testosterone levels ≥70 nmol/L had significantly higher odds of infertility (aOR = 2.67, $p = 0.001$). Comparable results have been documented in Middle Eastern and South Asian cohorts, where 65–80% of PCOS patients exhibit biochemical evidence of androgen excess (42). Elevated LH/FSH ratios (>2) in 35.6% of cases further support the presence of hypothalamic-pituitary dysregulation, a hallmark of the classic PCOS phenotype (43). Variability in gonadotropin ratios among populations may reflect differences in assay sensitivity, obesity prevalence, and ethnic endocrinologic profiles (44).

Clinical manifestations such as acne (58.6%) and hirsutism (53.6%) were notably frequent and comparable to global reports indicating dermatologic features in 50–70% of PCOS women (45). The presence of hirsutism and acne in this population underscores both biochemical and cutaneous androgenic activity. Moreover, obesity and overweight combined accounted for 94.6% of the cohort, illustrating a critical metabolic dimension of PCOS. This observation parallels studies from Karachi and Lahore that reported obesity rates of 85–90% among PCOS patients (46). Excess adiposity contributes to insulin resistance, hyperinsulinemia, and compensatory ovarian androgen production, creating a vicious metabolic–endocrine feedback loop (47). The significant association between obesity and infertility in this study (aOR = 1.92, $p = 0.017$) reaffirms the detrimental role of adiposity in ovulatory dysfunction and reproductive outcomes.

An additional and important dimension revealed by this study is the high prevalence of psychological comorbidities, with 74.8% of participants reporting depressive symptoms. This aligns with emerging evidence that PCOS not only disrupts reproductive function but also profoundly affects mental well-being (48). Hyperandrogenism, obesity, and infertility have been independently linked to mood disturbances through neuroendocrine and psychosocial pathways (49). The association between depression and infertility ($p = 0.033$) observed in this study reinforces the need for integrated mental health screening and support within PCOS management protocols.

Familial clustering of PCOS, reported in 29.2% of participants, and the significant correlation with parental consanguinity (first-cousin marriages in 34.4%) support the hypothesis of genetic predisposition within this population. Previous studies have suggested that familial aggregation and specific gene polymorphisms (e.g., CYP11A1, FSHR, and INS-VNTR) may play roles in PCOS heritability, particularly in South Asian populations with high rates of consanguinity (50). The observed association (OR = 1.89, 95% CI: 1.23–2.88) provides epidemiologic evidence consistent with these genetic frameworks.

From a clinical standpoint, the constellation of oligomenorrhea, elevated testosterone, obesity, and polycystic ovarian morphology identified as predictors of infertility highlights the multifactorial reproductive impact of PCOS. These findings align with the theoretical model proposed by Azziz et al. (2016), which conceptualizes PCOS as a spectrum disorder driven by the interaction of metabolic and neuroendocrine factors (51). The slight inverse relationship between age and infertility (aOR = 0.94) may reflect adaptive reproductive interventions or declining clinical severity with age, as previously reported by Teede et al. (2010) (52).

The findings of this study advance current understanding by providing one of the largest clinic-based datasets from Pakistan, a region where PCOS epidemiology remains underexplored. The study's strengths include its robust sample size, standardized hormonal and ultrasound assessment, and multivariate analytical approach addressing potential confounders. Additionally, the integration of psychological parameters such as depression adds a novel dimension rarely explored in regional studies.

Nonetheless, several limitations should be acknowledged. The hospital-based recruitment may have introduced selection bias, limiting generalizability to the wider community. The cross-sectional design precludes temporal or causal inference. Although hormonal assays were standardized, the absence of free androgen index and insulin sensitivity measures constrained metabolic interpretation. Moreover, self-reported dietary and psychological variables may be subject to recall bias. Despite these limitations, the study provides a valid and contextually rich epidemiologic snapshot of PCOS in a Pakistani population.

Future research should aim to expand this work through multicenter longitudinal studies incorporating genetic, metabolic, and lifestyle factors. Investigations exploring gene–environment interactions, insulin resistance biomarkers, and targeted lifestyle interventions could further elucidate the pathophysiology of PCOS in South Asian women. Public health initiatives integrating reproductive endocrinology with nutrition and mental health services are also warranted to mitigate the long-term reproductive and metabolic consequences of PCOS in this population.

In conclusion, this study underscores the complex interplay between hormonal, metabolic, and psychosocial dimensions of PCOS. The high prevalence of infertility, obesity, and depression among affected women in Gujranwala calls for comprehensive, multidisciplinary management strategies emphasizing early diagnosis, lifestyle modification, and mental health support. By situating local findings within the global context, this research contributes meaningful evidence toward understanding and addressing PCOS as a multifaceted public health issue in South Asia.

CONCLUSION

This study provides a comprehensive profile of women with polycystic ovary syndrome (PCOS) in Gujranwala, Pakistan, emphasizing its multifaceted reproductive, metabolic, and psychosocial impact. The findings reveal that PCOS predominantly affects women aged 20–34 years, with the majority presenting with oligomenorrhea, hyperandrogenism, obesity, and infertility. Elevated testosterone levels, menstrual irregularity, obesity, and ultrasound-confirmed polycystic ovarian morphology were the most significant predictors of infertility, underscoring the intricate hormonal and metabolic interactions underlying reproductive dysfunction.

The high prevalence of depression highlights the often-overlooked psychological burden of PCOS, suggesting that emotional distress and infertility may share interrelated endocrine and psychosocial pathways. The observed familial aggregation and consanguinity-associated risk indicate possible genetic underpinnings in this population, warranting molecular and genomic exploration in future studies.

Clinically, these findings reinforce the need for early detection and multidisciplinary management approaches that integrate endocrinologic, nutritional, and psychological care. Public health programs should prioritize awareness, screening, and counseling for young women at risk, particularly in urban settings where sedentary lifestyles and dietary factors exacerbate PCOS manifestations.

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