



ARTICLE METADATA

Article History

Received:	26 July 2026
Revised:	23 August 2026
Accepted:	18 September 2026
Published:	03 October 2026

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Keywords: Polycystic Ovary Syndrome, Lifestyle Risk Factors, Insulin Resistance, Obesity, Metabolic Abnormalities.

DOI: [10.64911/h9a34e54](https://doi.org/10.64911/h9a34e54)

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Original Article

Prevalence of Polycystic Ovarian Syndrome and its Associated Lifestyle Risk Factors: A Cross-Sectional Study

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Abstract

Objective: To assess the prevalence, clinical manifestations, metabolic abnormalities, and lifestyle-related risk factors of PCOS among women of reproductive age attending a tertiary care hospital in Nowshera, Pakistan.

Methodology: This Cross-Sectional Study was conducted in the Department of Obstetrics and Gynecology, MTI Nowshera Medical College (NMC), Qazi Hussain Ahmad Medical Complex, Nowshera, KP, Pakistan, from January to June 2025. A total of 200 women aged 18–44 years diagnosed with PCOS according to the Rotterdam criteria were enrolled through consecutive sampling. We collected data on sociodemographic characteristics, anthropometric measurements, clinical features, biochemical parameters, and lifestyle factors using a structured questionnaire. We performed statistical analyses using SPSS version 27.

Results: The mean age was 24.6 ± 4.8 years, with the largest proportion in the 21–25-year age group (42.0%). Menstrual irregularity (81.0%) was the most common clinical manifestation, followed by acne (51.0%), hirsutism (48.0%), and infertility (37.0%). Overweight/obesity and central obesity were observed in 62.0% and 59.0% of participants, respectively. Sedentary behavior, frequent fast-food consumption, psychological stress, and sleep disturbances were highly prevalent. Elevated testosterone (64.0%), abnormal LH/FSH ratio (56.0%), dyslipidemia (52.0%), and impaired fasting glucose (38.0%) were common metabolic abnormalities. Obesity (AOR=3.12), physical inactivity (AOR=2.95), and sedentary lifestyle (AOR=2.67) were significant independent predictors of PCOS severity.

Conclusion: Obesity, physical inactivity, and unhealthy lifestyle behaviors significantly contribute to PCOS severity. Early diagnosis, lifestyle modification, and multidisciplinary management are essential to reduce its reproductive and metabolic burden.

How to Cite: Sumayya, Mehwish S, Saleem J, Safi S, Nawaz S. Prevalence of polycystic ovarian syndrome and its associated lifestyle risk factors: a cross-sectional study. *J Pak Int Med Coll.* 2026;3(3):65-69.

Introduction

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders among women of reproductive age, affecting approximately 8–13% globally. It is a heterogeneous condition involving hyperandrogenism, ovulatory dysfunction, and polycystic ovarian morphology that has significant metabolic and reproductive implications [1]. PCOS is now recognized as a condition that affects multiple systems of the body, which also commonly includes insulin resistance, obesity, dyslipidemia, hypertension, type 2 diabetes mellitus, cardiovascular risk, and poor quality of life [2,3]. Despite its high prevalence, many women with PCOS are not identified, due to variable clinical presentations, limited awareness, poor screening, and issues accessing health services [4]. Insulin resistance and hyperinsulinemia are important factors in the pathogenesis of PCOS, as they stimulate ovarian androgen production and inhibit sex hormone-binding globulin, which are mechanisms responsible for hyperandrogenism and ovulatory dysfunction, respectively [5,6]. Other factors include genetic susceptibility, obesity, chronic low-grade inflammation, oxidative stress, and lifestyle factors, all of which contribute to disease expression [7]. As obesity, physical inactivity, unhealthy eating habits, and psychosocial stress continue to rise, the metabolic load of PCOS may be further exacerbated. Data indicate that lifestyle modifications, such as increased exercise and dietary changes, can improve metabolic, hormonal, and reproductive parameters [8]. Nutritional transition, sedentary lifestyle, reproductive health stigma, and the lack of specialist care may also be contributing factors to the burden of PCOS in South Asian populations, including Pakistan [9]. While there is a wealth of research on PCOS from around the world, there is not much locally generated evidence that incorporates clinical features, metabolic abnormalities, anthropometric measures, and lifestyle-related factors within the context of women with PCOS in Pakistan. This study aimed to determine the prevalence, clinical characteristics, metabolic abnormalities, and lifestyle-related risk factors of PCOS among women attending a tertiary care center in Nowshera, Khyber Pakhtunkhwa, Pakistan. This study's novelty lies in its integrated assessment of reproductive, metabolic, anthropometric, and lifestyle characteristics within a tertiary-care population in this relatively understudied region of Pakistan. [10]

Materials and Methods

This cross-sectional study was conducted from January 2025 to June 2025 at the Department of Obstetrics and Gynecology, Qazi Hussain Ahmad Medical Complex (QHAMC) and Nowshera Medical College (NMC), Nowshera, Khyber Pakhtunkhwa, Pakistan. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies. The target population comprised women of reproductive age (15–44 years) presenting to the study centers with gynecological, reproductive, endocrine, or menstrual health concerns during the data collection period. We used consecutive (non-probability) sampling, enrolling all eligible women who met the predefined inclusion and exclusion criteria until we reached the target sample size. We chose this method to minimize selection bias and ensure the sample represented the clinic-based population. Women aged 18–44 years with a confirmed diagnosis of PCOS based on the Rotterdam criteria were included. PCOS was diagnosed when at least two of the following three criteria were met: (i) oligo-ovulation or anovulation, (ii) clinical and/or biochemical evidence of hyperandrogenism, and (iii) polycystic ovarian morphology (PCOM) on pelvic ultrasonography, following exclusion of other androgen excess disorders. Women were excluded if they had confirmed pregnancy, thyroid dysfunction, hyperprolactinemia, congenital adrenal hyperplasia (CAH), Cushing syndrome, androgen-secreting tumors, or severe chronic systemic illness. We also excluded participants with incomplete clinical records or those who declined informed written consent. We calculated the sample size using the WHO formula for prevalence studies: $n = Z^2P(1-P)/d^2$, where

$Z = 1.96$ (95% confidence level), $P =$ the estimated PCOS prevalence of 20% based on published regional literature, and $d = 0.05$ (margin of error). This yielded a minimum required sample of 196 participants; we enrolled 200 participants to account for potential incomplete data and provide adequate statistical power for subgroup and regression analyses.

Data Collection Instruments

We developed a structured, pretested, expert-validated questionnaire following a systematic literature review. The instrument comprised five sections: (i) sociodemographic characteristics (age, marital status, residence, education, occupation); (ii) menstrual and reproductive history; (iii) family history of endocrine or metabolic disorders; (iv) lifestyle factors including dietary patterns, physical activity, screen time, sleep quality, and psychosocial stress; and (v) clinical symptom history including menstrual irregularity, hirsutism, acne, alopecia, and infertility. We piloted the questionnaire with approximately 10% of the target sample before full-scale data collection to assess clarity, feasibility, and internal consistency. Pilot data were excluded from the final analysis. We revised the questionnaire based on pilot feedback before commencing the main study.

Anthropometric and Clinical Assessments

We recorded body weight in kilograms using a calibrated electronic weighing scale, with participants in light clothing and without footwear. We measured height in centimeters using a wall-mounted stadiometer in the standard anatomical position. We calculated Body Mass Index (BMI) as weight (kg)/height (m)² and classified it according to WHO criteria: underweight (<18.5), normal (18.5–24.9), overweight (25.0–29.9), and obese (≥ 30.0 kg/m²). Waist circumference was measured at the midpoint between the lower costal margin and the iliac crest to define central obesity (waist circumference >80 cm in women per IDF criteria). Trained gynecologists assessed clinical features. We graded hirsutism severity using the modified Ferriman–Gallwey (mFG) scoring system; a score ≥ 8 indicated hirsutism. We documented acanthosis nigricans, acne, alopecia, and other dermatological manifestations through clinical examination.

Biochemical and Ultra sonographic Investigations

We retrieved laboratory parameters, including fasting blood glucose, serum testosterone, luteinizing hormone (LH), follicle-stimulating hormone (FSH), lipid profile (total cholesterol, triglycerides, HDL-C, LDL-C), and fasting insulin, from patients' existing medical records and diagnostic reports where available. Dyslipidemia was defined per the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria. We reviewed pelvic ultra sonographic findings from records; we defined PCOM as ≥ 12 follicles measuring 2–19 mm in at least one ovary, or ovarian volume >10 mL.

Lifestyle Assessment

We assessed lifestyle-related variables by self-report using standardized instruments adapted from validated epidemiological tools. Physical activity was categorized as regular (≥ 30 min of moderate-intensity activity on ≥ 5 days/week), irregular (1–4 days/week), or sedentary (<1 day/week). We assessed dietary habits using food frequency questions covering fast food consumption, sugary beverage intake, and meal regularity. We assessed sleep quality using a modified Pittsburgh Sleep Quality Index (PSQI), dichotomized as adequate or disturbed. We evaluated psychological stress using a 4-item Perceived Stress Scale (PSS-4), categorized as low or high stress.

Statistical Analysis

We coded, entered, cleaned, and analyzed data using IBM SPSS Statistics version 27.0. Descriptive statistics summarized all variables: continuous

variables were presented as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. We examined associations between lifestyle risk factors and PCOS severity using chi-square tests (categorical variables), independent-samples t-tests (two-group continuous comparisons), and one-way ANOVA (multi-group comparisons). Variables significant at $p < 0.05$ in univariable analyses were entered into multivariable binary logistic regression to identify independent predictors of PCOS severity, with results expressed as adjusted odds ratios (AORs) with 95% confidence intervals (CIs). We set statistical significance at $p < 0.05$ throughout.

Results

A total of 200 women with confirmed PCOS were enrolled. The mean age was 24.6 ± 4.8 years (range: 18–45 years). The highest prevalence was observed in the 21–25-year age group (42.0%), followed by the 26–30-year group (28.5%), indicating that young reproductive-aged women constitute the most affected demographic. Most participants were married (56.0%), urban residents (63.0%), housewives (59.0%), and educated to the secondary level (39.0%). Table 1 presents the complete sociodemographic profile.

Table 1. Sociodemographic Characteristics of Study Participants (n = 200)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	18–20	38	19.0
	21–25	84	42.0
	26–30	57	28.5
	>30	21	10.5
Marital Status	Married	112	56.0
	Unmarried	88	44.0
Residence	Urban	126	63.0
	Rural	74	37.0
Education	Primary	34	17.0
	Secondary	78	39.0
	Graduate	64	32.0
	Postgraduate	24	12.0
Occupation	Housewife	118	59.0
	Employed	82	41.0

Anthropometrically, the mean BMI was 27.8 ± 5.1 kg/m², categorizing the mean Participant in the overweight range. Overall, 37.0% were overweight, and 25.0% were clinically obese (BMI ≥ 30 kg/m²). Central obesity, defined as waist circumference >80 cm, was present in 59.0% of participants. Only 31.0% had a normal BMI, and 7.0% were underweight (Table 2).

Table 2. Anthropometric Characteristics of Study Participants (n = 200)

Parameter	Category / Value	Frequency (n)	Percentage (%)
Weight (kg)	Mean ± SD: 68.4 ± 12.6	—	—
Height (cm)	Mean ± SD: 159.2 ± 6.3	—	—
BMI (kg/m ²)	Mean ± SD: 27.8 ± 5.1	—	—
BMI Category	Underweight (<18.5)	14	7.0
	Normal (18.5–24.9)	62	31.0
	Overweight (25.0–29.9)	74	37.0
	Obese (≥ 30.0)	50	25.0
Central Obesity	Present (WC >80 cm)	118	59.0

Absent	82	41.0
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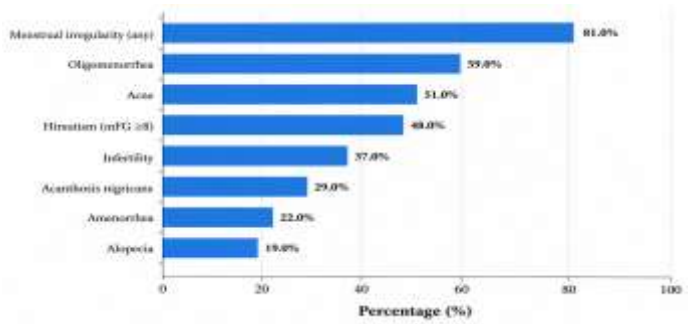
Clinical Manifestations

Menstrual irregularity was the most prevalent clinical feature, affecting 81.0% of participants; oligomenorrhea was present in 59.0% and amenorrhea in 22.0%. Hyperandrogenic features were common: acne was documented in 51.0% and hirsutism in 48.0% of participants. Infertility was reported by 37.0%, while acanthosis nigricans, a cutaneous marker of insulin resistance, was detected in 29.0% and alopecia in 19.0%. Table 3 presents the clinical profile.

Table 3. Clinical Manifestations in Women with PCOS (n = 200)

Clinical Feature	Frequency (n)	Percentage (%)
Menstrual Irregularity (any)	162	81.0
Oligomenorrhea	118	59.0
Amenorrhea	44	22.0
Acne	102	51.0
Hirsutism (mFG ≥ 8)	96	48.0
Infertility	74	37.0
Acanthosis Nigricans	58	29.0
Alopecia	38	19.0

Figure 1: Bar chart showing prevalence of clinical manifestations in PCOS participants (n=200)



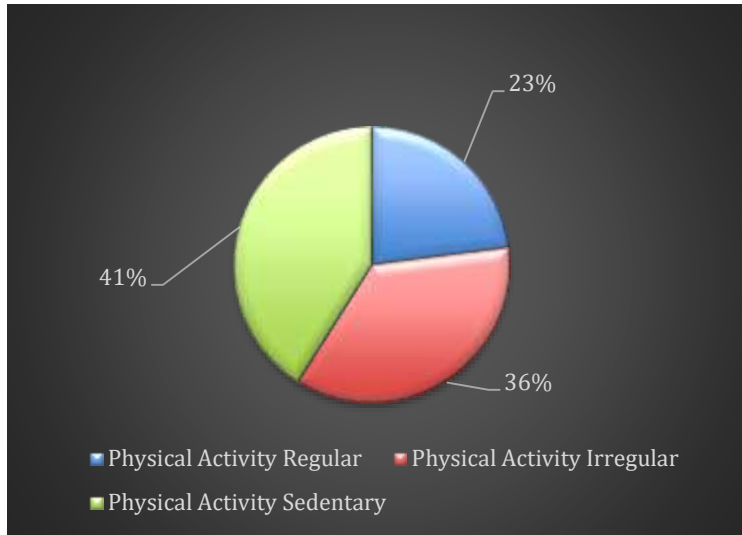
The distribution of clinical features shows a predominance of menstrual abnormalities and hyper androgenic signs in this population.

Table 4. Lifestyle Characteristics and Biochemical/Ultrasound Findings (n = 200)

Variable	Category / Finding	Frequency (n)	Percentage (%)
Physical Activity	Regular	46	23.0
	Irregular	72	36.0
	Sedentary	82	41.0
Fast Food Intake	Frequent ($>3\times/\text{week}$)	96	48.0
	Occasional (1– $3\times/\text{week}$)	78	39.0
	Rare ($<1\times/\text{week}$)	26	13.0
Sugary Beverage Use	Regular	124	62.0
Sleep Disturbance	Present	108	54.0
High Psychological Stress	Present	132	66.0

Elevated Testosterone	Present	128	64.0
Abnormal LH/FSH Ratio	Present	112	56.0
Dyslipidemia	Present	104	52.0
Impaired Fasting Glucose	Present	76	38.0
PCOM on Ultrasound	Confirmed	176	88.0

Figure 2: showing physical activity levels: Sedentary 41%, Irregular 36%, Regular 23%



Distribution of Physical Activity Levels Among Study Participants (n = 200)

Association and Regression Analysis

Chi-square analysis revealed statistically significant associations between BMI and menstrual irregularity (p = 0.001), physical activity level and obesity (p = 0.002), and psychological stress and hormonal symptoms (p = 0.003). ANOVA demonstrated a significant association between dietary pattern and metabolic abnormalities (p = 0.001). An independent t-test confirmed a significant relationship between sleep disturbance and hormonal imbalance (p = 0.010). Multivariable logistic regression analysis, adjusting for age, marital status, and residence, identified obesity (AOR = 3.12; 95% CI: 1.82–5.41; p = 0.001), physical inactivity (AOR = 2.95; 95% CI: 1.70–5.11; p = 0.001), and sedentary lifestyle (AOR = 2.67; 95% CI: 1.55–4.60; p = 0.002) as the three strongest independent predictors of PCOS severity. Unhealthy diet (AOR = 2.41) and positive family history (AOR = 1.89) were additional significant independent predictors. Women with obesity were more than three times as likely to experience severe PCOS manifestations compared to those with normal BMI.

Discussion

This study provides an integrated assessment of the clinical, metabolic, anthropometric, and lifestyle characteristics of PCOS among reproductive-aged women attending a tertiary-care hospital in Nowshera, Pakistan. The results validate the concept of PCOS as a multisystem metabolic-endocrine disorder with reproductive features that are associated with obesity, insulin resistance, and modifiable lifestyle factors. The largest age group by percentage was women aged 21-25 years. This is consistent with other evidence of the common association of PCOS presenting in early reproductive adulthood, following the onset of menstruation, hyper androgenic symptoms, and fertility issues [11]. The

high proportion of younger women may also reflect greater exposure to sedentary lifestyles, dietary changes, psychosocial stress, and disrupted sleep [12]. This urban predominance observed further underscores the possibility that urbanization and lifestyle change may contribute to PCOS risk. Sedentary behaviors, energy-dense diets, and higher psychosocial stress likely contribute to the expression of PCOS and/or obesity and insulin resistance [13,14]. This cohort was overweight and obese, with about 62% being overweight or obese. This is clinically significant because excess adiposity, especially visceral fat, is closely associated with insulin resistance, inflammation, and hyperandrogenism in PCOS [15]. The positive association between BMI and menstrual irregularity in this study is biologically plausible because hyperinsulinemia can stimulate ovarian androgen production and decrease sex hormone-binding globulin in the liver, leading to higher circulating androgen levels [16]. Menstrual irregularity was the most common clinical feature, and approximately one-third were infertile. These results reveal the considerable reproductive burden associated with PCOS and confirm the major role played by ovulatory dysfunction in the disorder [17]. Hyper androgenic symptoms also occurred often: Acne (51%) and hirsutism (48%). The occurrence of acanthosis nigricans in 29% also indicates a significant prevalence of insulin resistance and underscores the significance of metabolic screening in women with PCOS [18]. Lifestyle factors were also significant. The most prevalent factors associated with participants were physical inactivity, poor nutrition habits, regular intake of fast food and sugar-sweetened drinks, psychological stress, and sleep disorders. These factors can negatively affect insulin resistance, obesity, inflammation, and reproductive function [19,20]. In the multivariable analysis, physical activity emerged as an important independent predictor, highlighting the potential role of regular physical activity in managing PCOS. Aerobic exercise has been shown to enhance insulin sensitivity, decrease visceral adiposity, and positively affect metabolic and reproductive parameters [21]. Other significant results included psychological stress and sleep disturbances. Excessive stress and poor sleep can negatively affect glucose metabolism, appetite control, inflammatory processes, and reproductive hormonal function [22,23]. These findings emphasize that PCOS management should extend beyond reproductive symptoms and incorporate lifestyle counseling, physical activity, dietary modification, stress management, and sleep optimization. Overall, the findings demonstrate a substantial overlap between reproductive manifestations and metabolic and behavioral risk factors among women with PCOS in this tertiary-care setting. The study highlights the need for earlier recognition and comprehensive assessment of modifiable risk factors in Pakistani women with PCOS.

Conclusion

PCOS is a prevalent endocrine-metabolic disorder among young reproductive-aged women in Pakistan, strongly associated with modifiable lifestyle risk factors including obesity, physical inactivity, sedentary behavior, poor dietary habits, psychological stress, and sleep disturbances. Obesity emerged as the most powerful independent predictor of PCOS severity. These findings underscore the urgent need for early identification, comprehensive lifestyle modification, and multidisciplinary, culturally responsive management to reduce the reproductive, metabolic, and psychosocial burden of PCOS in Pakistan.

Declarations

Conflicts of Interest: The authors declare no conflicts of interest.

Funding: This study received no external funding.

Ethical Approval: Ethical approval was granted by the Ethical Review Board (ERB) of Nowshera Medical College (Approval No. 12(i)/ERB/NMC, dated 01/01/2025).

Authors' Contributions

Sumayya: Study supervision, interpretation of findings, critical review of the manuscript for important intellectual content, final approval of the version to be published, and accountability for all aspects of the work.

Mehwish Sayed: Data collection, laboratory assessment, data curation, literature review, manuscript revision, final approval of the version to be published, and accountability for all aspects of the work

Javeria Saleem: Statistical analysis, interpretation of data, manuscript drafting and revision, critical review of the manuscript for important intellectual content, final approval of the version to be published, and accountability for all aspects of the work.

Saeeda Safi: Conceptualization, study design, data collection, data curation, statistical analysis, interpretation of data, manuscript drafting, critical revision of the manuscript, final approval of the version to be published, and accountability for all aspects of the work.

Shah Nawaz: Data acquisition, data analysis, critical revision of the manuscript, and supervision.

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