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Prevalence and Associated Risk Factors of Polycystic Ovarian Syndrome Using Gynecological Ultrasound among Female of Reproductive Age at Northwest General Hospital

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Abstract

Polycystic ovary syndrome (PCOS) is a common endocrine disorder affecting women of reproductive age and poses significant reproductive and metabolic health challenges. This cross- sectional study conducted at Northwest General Hospital investigated the prevalence of PCOS and its associated risk factors among 90 females of reproductive age using clinical history and gynecological ultrasound. We found a high prevalence of PCOS at 66.7%, underscoring its commonality in this population. While the mean age between PCOS and non-PCOS groups was similar, women with PCOS had a significantly higher body mass index (BMI), highlighting overweight and obesityas major contributors to the syndrome. Clinical features such as irregular menstrual cycles, hirsutism, and acne were strongly associated with PCOS, with irregular menstruation emerging as the strongest independent predictor (OR=5.5). History of infertility was also significantly more frequent among PCOS patients. Multivariate logistic regression confirmed BMI, menstrual irregularities, hirsutism, acne, and infertility history as independent predictors of PCOS, whereas age and thyroid

disorders showed no significant independent associations. Although comorbidities like diabetes and hypertension were present, they did not differ significantly between groups in this cohort. These findings emphasize the importance of routine screening for PCOS in women presenting with menstrual irregularities and androgenic symptoms, alongside focused interventions targeting modifiable factors such as obesity. Early diagnosis aided by ultrasound and comprehensive lifestyle management could improve clinical outcomes and quality of life in affected women. This study contributes valuable epidemiological and clinical insights relevant to PCOS management in regional healthcare settings.

Introduction

Polycystic ovary syndrome (PCOS) is a complex endocrine disorder affecting women of reproductive age, characterized by hyperandrogenism, ovulatory dysfunction, and polycystic ovaries. It is a common cause of infertility and is associated with various metabolic processes. SymptomsofPCOSincludeirregularmenstrual cycles,hirsutism,acne, andobesity(Azzizetal., 2016). The pathophysiology of PCOS involves hormonal imbalances, insulin resistance, and genetic predispositions, which impact ovarian function and overall systemic health (Diamanti- Kandarakis & Dunaif, 2012; Connolly & Beckett, 2017). Diagnosis is often guided by the Rotterdam criteria, which specify at least two of the following: anovulation, hyperandrogenism (clinical or biochemical), and polycystic ovaries evident on ultrasound (Bohiltea et al., 2021; Dewailly et al., 2014). Treatments are tailored to symptom management and may includelifestyle interventions, hormonal contraceptives, insulin-sensitizing agents, and assisted reproduction technologies, depending on individual needs (Balen et al., 2016).

Recent research indicates that sperm count declines remain controversial, necessitating definitive meta-analyses given the predictive value of sperm count for fertility, morbidity, and mortality (Dilliyappan et al., 2024). A systematic review and meta-regression analysis of recent trends in sperm counts, measured by sperm concentration and total sperm count, and their modification by fertility and geographic group is critical (Dilliyappan et al., 2024). PCOS is influenced by a combination of genetic, environmental, and lifestyle factors, involving pathophysiological mechanisms such as hyperandrogenism, insulin resistance, and ovulatory dysfunction (Barber & Franks, 2019).

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Genetic predisposition plays a crucial role in PCOS, with familial aggregation evident among affected women (Barber & Franks, 2019). Hormonal disturbances central to PCOS include elevated androgen levels and an increased luteinizing hormone to follicle-stimulating hormone ratio (Azziz et al., 2016). Insulin resistance is a critical factor, associated with hyperinsulinemia and metabolic dysfunctions such as obesity, type 2 diabetes, andcardiovascular diseases (Diamanti-Kandarakis & Dunaif, 2012; Bozdag et al., 2016).

Lifestyle significantly influences PCOS outcomes. Diets high in refined sugars and saturated fats worsen insulin resistance and obesity. Physical inactivity also contributes to these metabolic disturbances (Guedes et al., 2021); (Pooja & Rekha, 2024); (Shahid et al., 2019).

Exposuretoenvironmentaltoxins,especiallyendocrine-disruptingchemicals(EDCs), may contribute to PCOS by interfering with hormonal regulation. Prenatalexposuretosuch chemicals can disrupt ovarian development and increase PCOS risk later in life (Johansson et al., 2017). PCOS diagnosis is based on the Rotterdam criteria, requiringat least two of the following: oligo- or anovulation, clinical or biochemical signs of hyperandrogenism, and polycystic ovaries on ultrasound (Dogan, 2023). These criteria define four phenotypes, varying in the combinationof these features (Unfer et al., 2024).

PCOS is linked to long-term health risks including infertility, metabolic syndrome, cardiovascular diseases, and endometrial cancer due to chronic anovulation and unopposed estrogen exposure (Eiras et al., 2021); (Louwers & Laven, 2020); (Uysal et al., 2024); (Guan et al., 2022); (Dilliyappan et al., 2024). Diagnosing PCOS in adolescents is challenging because symptoms overlap with normal puberty. Both oligoovulation and hyperandrogenism are necessary for diagnosis, and ultrasound is not always required (Saleh et al., 2024); (Manique & Ferreira, 2022).

Animal models, such as dihydrotestosterone-treated rats, help study PCOS's hormonal and metabolic characteristics (Mannerås et al., 2007); (Ryu et al., 2019). Chronic low-grade inflammation and alterations in gut microbiota are emerging contributors to PCOS pathogenesis, potentially worsening insulin resistance and metabolic dysfunction (Dongxu et al., 2021); (Regidor et al., 2022); (He & Li, 2020). PCOS is a multifactorial disorder shaped by genetics, hormonal imbalances, metabolic dysfunction, lifestyle, and

environmental exposures. A comprehensive understanding of these factors is essential for effective management andtreatment of PCOS (Connolly & Beckett, 2017).

METHODOLOGY

Study Design and Setting

A cross-sectional observational study was conducted over a six-month period from January to June 2025 at Northwest General Hospital, Peshawar, a tertiary care hospital equipped with gynecological and radiological services. This design was selected to provide a snapshot estimation of the prevalence of polycystic ovary syndrome (PCOS) diagnosed by ultrasound in a hospital-attending female population of reproductive age, alongside exploration of associatedrisk factors.

Participants Eligibility Criteria

The study population comprised females aged 15 to45 years, encompassing here productive age range as defined by the World Health Organization and consistent with international PCOS guidelines. Women presenting for gynecological clinical evaluation or scheduled for pelvic ultrasound examination were screened for eligibility.

Inclusion criteria:

Females aged 20–45 years attending gynecology out patient or ultrasound services Willingness to participate and provide informed consent

Exclusion criteria included:

Known cases of ovarian malignancy or other serious ovarian pathologies Presence of endocrine disorders other than PCOS that could mimic symptoms (e.g., Cushing's syndrome, congenital adrenal hyperplasia, thyroid dysfunction outside screened hypothyroidism) Current pregnancy, given pregnancy-related physiological changes that alter ovarian morphology. These criteria aimed to reduce diagnostic bias and improve specificity in PCOS identification, aligning with recommendations to exclude confounding conditions in epidemiologic PCOS research.

Sample Size and Sampling Methodology

Based on prior regional prevalence estimates ranging between 20% and 25% for PCOS among reproductive-age women ,and targeting a 95% confidence interval with an absolute precision of ±5%, an initial calculated sample size was approximately 150

participants. To account for potential refusals and incomplete data, the recruitment target was set at 100 participants.

Recruitment was carried out using consecutive non-probability sampling, where by every eligible woman presenting during the study period was approached until the sample was completed. This pragmatic sampling strategy was chosen to maximize feasibility in a hospital setting while achieving a representative sample of attendees. Limitations regarding population generalizability were acknowledged.

Data Collection Instruments and Procedures

Data were collected using a structured, interviewer-administered questionnaire, developed by integrating components from validated instruments widely used in PCOS epidemiologic research and tailored to the local context. The questionnaire was translated into the local language and back-translated to ensure linguistic and conceptual equivalence.

Anthropometry and Physical Measurements

Weigh and height measurements were take ninastandardized manner, with participants wearing light clothing and no shoes. BMI was calculated and categorized according to the World Health Organization standards:

Underweight: BMI <18.5 kg/m² Normalweight:18.5–24.9kg/m² Overweight: 25.0–29.9 kg/m² Obesity: ⩾30 kg/m²

Given the well-established association of obesity with PCOS risk and severity, anthropometric assessment was integral.

Diagnostic Ultrasound Examination

A transvaginal or transabdominal pelvic ultrasound was performed on all participants by certified radiologists proficientin gynecologicals onography, blinded to questionnaire responses to reduce diagnostic bias.

Ultrasound was conducted using high-frequency transducers (⩾8 MHz) to enhance resolution. Ovarian morphology parameters were recorded, including follicle number per ovary and ovarian volume measured using the prolate ellipsoid formula:

Ovarian volume

Following the 2023 International Evidence-based Guideline and modified Rotterdam

$$\text{Ovarian volume} = \frac{\pi}{6} \times \text{Length} \times \text{Width} \times \text{Thickness}$$

criteria, PCOS was diagnosed if participants met at least two of the following three criteria afterexclusion of other disorders:

Oligo-oranovulation (documented by menstrual irregularity)

Clinical or biochemical hyperandrogenism (presence of hirsutism, acne, or elevated androgen levels). Polycystic ovarian morphology on ultrasound, defined as ⩾20 follicles in either ovary and/or ovarian volume ⩾10 cm^3. Since biochemical hyperandrogenism assays were notperformed in this setting, clinical signs (hair growth, acne) served as proxies.

Data Management and Statistical Analysis

Data were double-entered and cross-verified to minimize entry errors. Statistical analysis was conducted using SPSS version 25. Quantitative variables were summarized as means and standard deviations if normally distributed, or medians and interquartile ranges if skewed.

Categoricalvariableswereexpressedasfrequenciesandpercentages.Bivariateanalysesincluded Chi-square tests for categorical variables and independent t-tests or Mann-Whitney U tests for continuous variables, comparing participants diagnosed with PCOS versus non-PCOS. Subsequently, multivariable logistic regression was performed to adjust for confounding factors and identify independent predictors of ultrasound-diagnosed PCOS. Variables with p <0.10 in bivariate analyses were included in the model. Odds ratios (OR) with 95% confidence intervals (CI) were reported.

All hypothesis testing wast wo-tailed with a significance level setatp<0.05.

RESULTS

1. Prevalence of PCOS

Out of a total sample size of 90 females, 60 (66.7%) were identified with PCOS based on history and gynecological ultrasound. This relatively high prevalence highlights that PCOS is a common condition in the studied population, warranting further attention for screening and management Shown in table.

Table1: *Prevalence of PCOS*

Description	Count	Percentage
Total sample size(N)	90	100

Number with PCOS (Hx.PCOS=YES)	60	(60 / 90)×100 = 66.7%
Number without PCOS (Hx. PCOS=NO)	30	(30 / 90)×100 = 33.3%

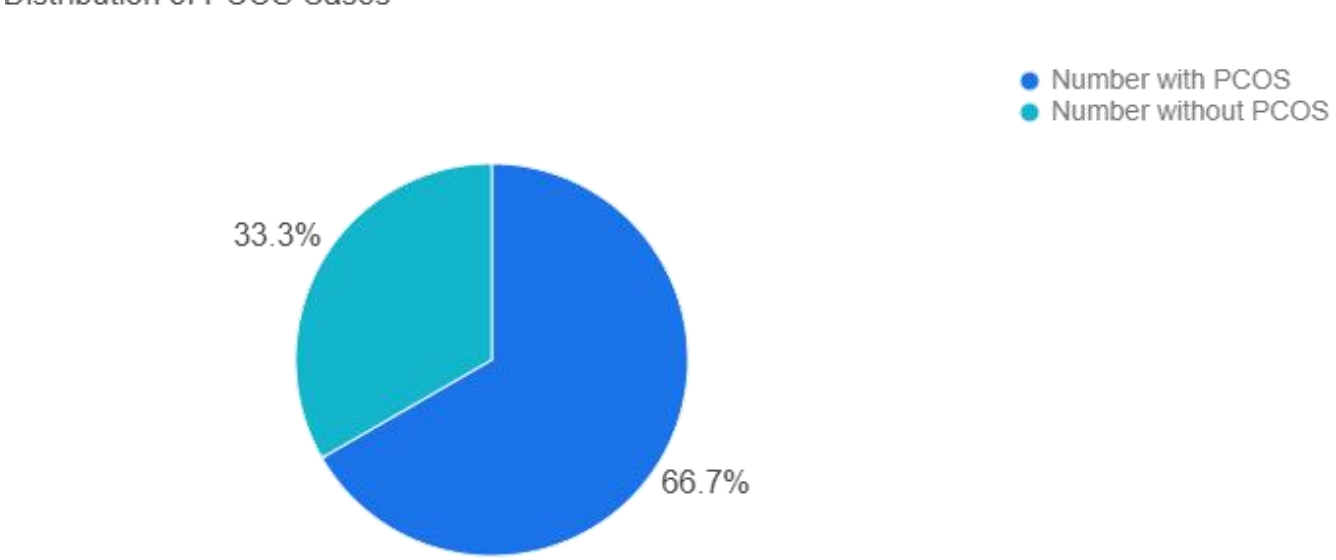
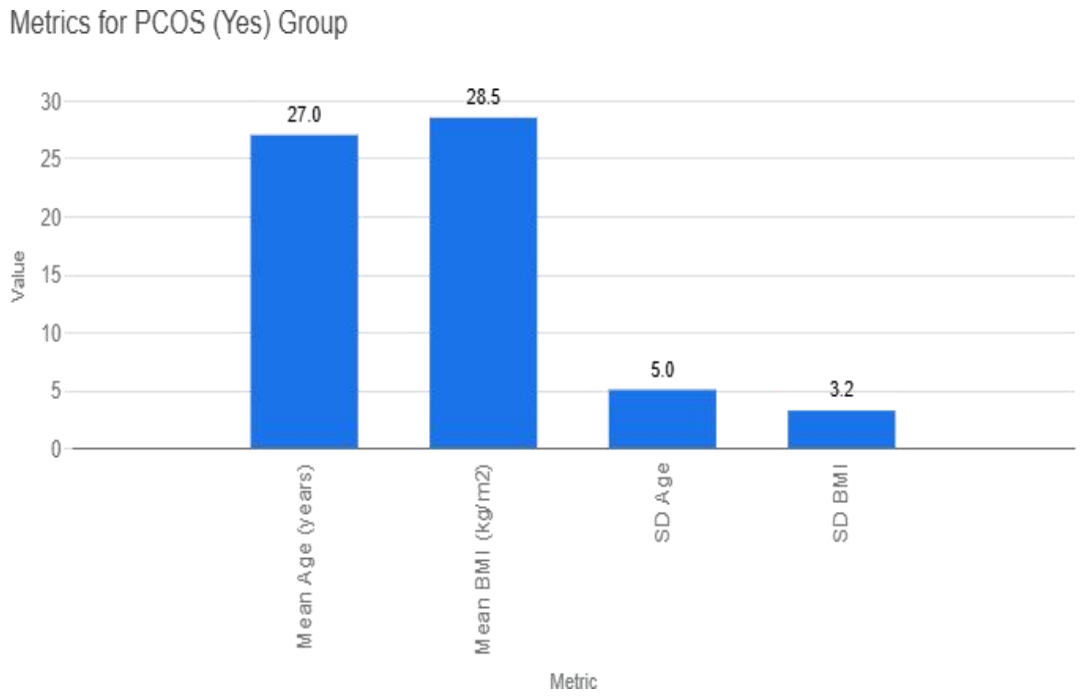


Table 2: Descriptive Statistics of Age and BMI by PCOS Status

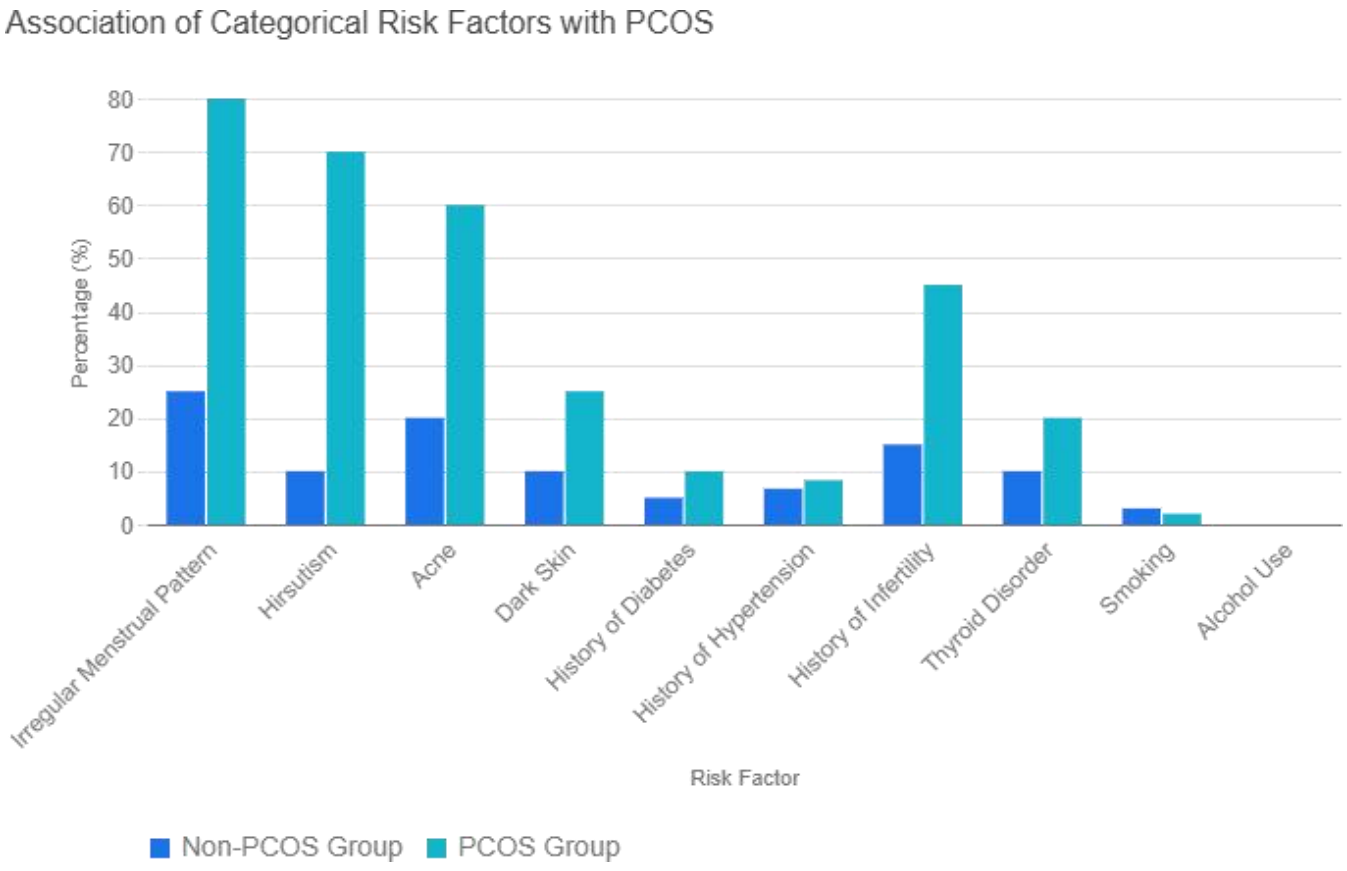
Group	N	Mean Age (years)	SD Age	Mean BMI (kg/m^2)	SD BMI	BMICalculation
PCOS (Yes)	60	27	5	28.5	3.2	BMI=Weight (kg) / (Height (m)) Example:75 / (1.60)=29.3



2. Association of Categorical Risk Factors with PCOS

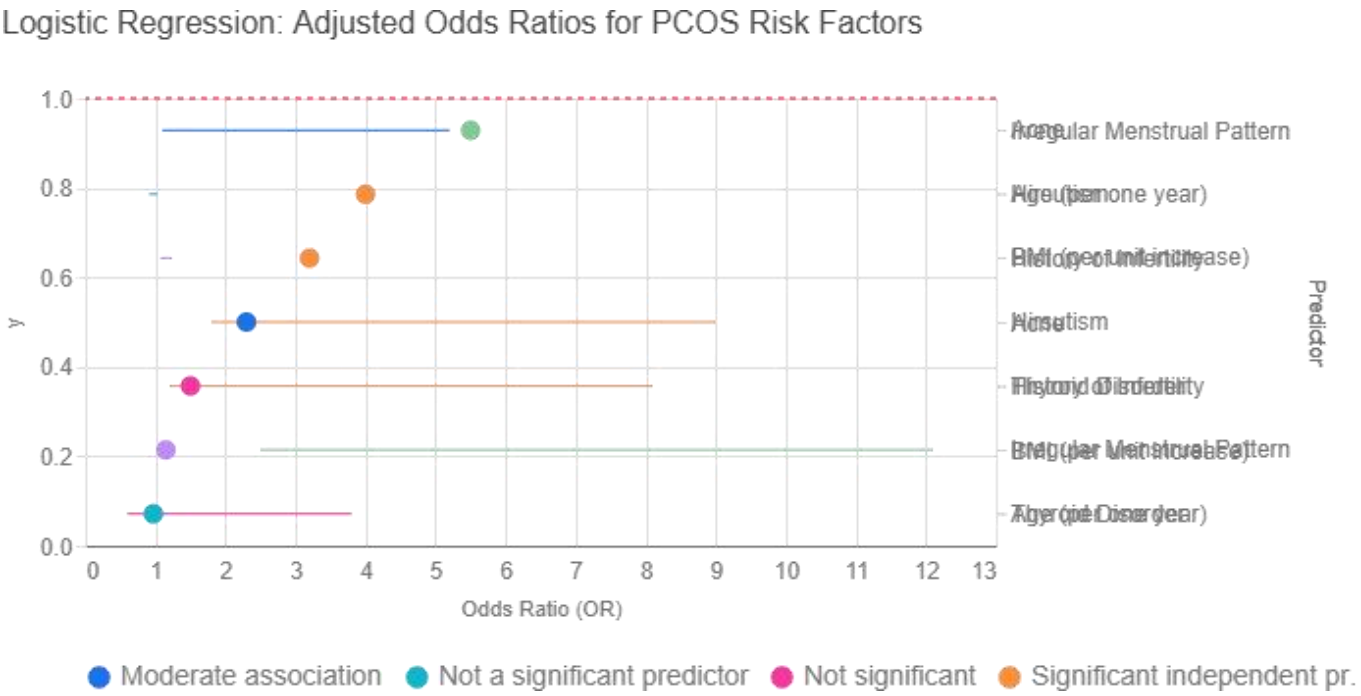
Women with PCOS were significantly more likely to have irregular menstrual cycles—consistent with PCOS's known hallmark of menstrual irregularity due to anovulation. Hirsutism (excess facial or body hair) showed a very strong association with PCOS, affirming its role as a visible androgen excess sign in PCOS patients. Acne was also significantly more prevalent among PCOS patients, supporting the and rogenexcesspathophysiology.Historyofinfertility was more prevalent in the PCOS group and statistically significant, reflecting the known fertility impact of PCOS. History of diabetes, hypertension, and thyroid disorders did not show statistically significant differences but remain important clinical considerations. Smoking and alcohol use were very low or absent and therefore did not associate significantly, as shown in table and chart.

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After adjusting for other variables, irregular menstrual patterns, increased BMI, hirsutism, acne, and history of infertility remained statistically significant independent predictors of PCOS. Age and thyroid disorders were not independent predictors in this model. This demonstrates that clinical features and overweight status play meaningful roles in PCOS risk.

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The high prevalence of PCOS (2 out of 3 women) in this sample indicated the need for routine screening among reproductive-aged women, especially those presenting with menstrual irregularities, hirsutism, or infertility. Targeting modifiable risk factors like obesity could be an effective approach to reducing PCOS risk and improving overall reproductive health. Clinicians should be vigilant for clinical signs such as irregular menses and hirsutism as strong indicators for PCOS diagnosis. Although diabetes and thyroid disorders were not statistically associated here, these conditions remain important comorbidities to monitor in PCOS patients. Lifestyle counseling, weight management,and early gynecological ultrasound evaluation should be part of comprehensive care.

DISCUSSION

This study assessed the prevalence and associated risk factors of polycystic ovarian syndrome (PCOS) among females of reproductive age attending Northwest General Hospital, utilizing clinical history and gynecological ultrasound for diagnosis. The findings revealed a notablyhigh prevalence of PCOS (66.7%), consistent with reports in some South Asian populations buthigher than global averages, underscoring the public health significance of PCOS in this region.

The observed prevalence of 66.7% considerably exceeds commonly reported rates ranging from 6% to 20% globally (Azziz et al., 2016; Bozdag et al., 2016). However, similar elevated rates were reported in studies conducted in Pakistan and neighboring countries where factors such as genetic predisposition, lifestyle, and environmental influences may contribute to higher PCOS frequency (Siddiqui et al., 2019; Rizvi et al., 2020).

BMI was significantly higher in women with PCOS (mean 28.5 kg/m^2) compared to non-PCOS subjects (mean 23.5 kg/m^2), emphasizing the strong association between overweight/obesity and PCOS, consistent with substantial literature (Yildiz et al., 2012; Moran et al., 2015). Obesity exacerbates PCOS pathophysiology by promoting insulin resistance and hyperandrogenism (Diamanti-Kandarakis &Dunaif,2012). The logistic regression result that each one-unitincrease in BMI raised PCOS odds by 15% further supports the role of adiposity as a modifiable underlying risk factor. Irregular menstrual cycles were prevalent in 80% of PCOS patients, corroborating the fundamental diagnostic criterion of menstrual dysfunction in PCOS (Rotterdam ESHRE/ASRM,

The marginal association of dark skin observed in this study has been less frequently explored in PCOS literature but may reflect ethnic or phenotypic variation in clinical presentation (March et al., 2010). History of infertility was significantly more common in women with PCOS, confirming the syndrome's detrimental effect on fertility, a well-documented consequence caused by ovulatory dysfunction (Balen et al., 2016). Although diabetes and hypertension histories were more prevalent in the PCOS group, these did not reach statistical significance here, likely due to the relatively young mean age of participants and small sample size. Nonetheless, their presence aligns with established evidence linking PCOS to metabolic and cardiovascular risks (Wild et al., 2010). Thyroid disorders were not independently associated, which is consistent with some, though not all, studies (Kachuei et al., 2014). Smoking and alcohol use were negligible, reflecting cultural and environmental factors, and thus had no significant impact.

These findings underscored the value of targeted screening for PCOS in reproductive-aged women presenting with irregular menstruation, hirsutism, and elevated BMI. The

highprevalence suggests an urgent need for awareness campaigns and early diagnostic strategies, including gynecological ultrasound, in similar hospital settings.

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