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Original Research Article

Polycystic ovary syndrome in Indian women: clinical spectrum and determinants from a regional multicenter study in Vidarbha region, Maharashtra, India

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ABSTRACT

Background: Polycystic ovary syndrome (PCOS) is a heterogeneous endocrine disorder with reproductive, metabolic, and psychological implications. Despite its high prevalence in Indian women, region-specific data on its clinical and metabolic spectrum remain limited. This study aims to evaluate the clinical presentation, anthropometric markers, metabolic profile, and phenotypic distribution of PCOS among adolescents and infertile women.
Methods: This cross-sectional retrospective, multicenter study was conducted across five centers between January 2022 and January 2023. A total of 309 women aged 14-32 years, diagnosed with PCOS, were enrolled. Data on demographic, reproductive, anthropometric, hormonal, biochemical, and ultrasonographic parameters were collated and analysed.
Results: The mean age of participants was 23.1±5.3 years, with mean menarche at 13.2±1.6 years. Among 153 married women, infertility duration averaged 3.2±2.5 years, with 90% reporting primary infertility. Ovulatory dysfunction was observed in 75.1%, hyperandrogenism in 46.3%, and polycystic ovarian morphology (PCOM) in 50.5%. Acne (46.3%) and acanthosis nigricans (36.2%) were frequent findings. The mean BMI was 25.4±5.3 kg/m², with 73.8% classified as overweight/obese. Neck circumference (33.6±4.0 cm) and wrist circumference (16.7±2.2 cm) showed correlation with insulin resistance. Among adolescents (n=156), hyperandrogenism was present in 55.8%, ovulatory dysfunction in 78%, and 20.5% showed PCOM.
Conclusions: PCOS in Vidarbha women shows early onset, high ovulatory dysfunction, obesity, insulin resistance, and adverse metabolic risks. Age-specific phenotypic variability underscores its evolving nature, necessitating early diagnosis, lifestyle changes, and comprehensive management to reduce reproductive and cardiometabolic complications.

Keywords: Adolescents, Infertility, Insulin resistance, Metabolic risk, Obesity, Phenotypes, Polycystic ovary syndrome, Vidarbha

INTRODUCTION

Polycystic ovarian Syndrome (PCOS) is a heterogeneous complex endocrinal disorder of varied etiologies, encompassing both reproductive and metabolic implications that extend well beyond a woman's reproductive age. PCOS affects substantial portion of women globally around 6-26%. This wide range could be due to variations in the diagnostic criteria and population demographics across different studies. Studies have shown that there is alarming rise in number of PCOS cases among adolescent and young women over the past few decades.[1,2] Currently, it has become the burning issue of the world.

The exact etiology of PCOS is unknown, however, it is supposed to be conglomeration of influences that contribute to the diverse gamut of clinical symptomatology. The multifactorial etiology includes genetic, insulin resistance, hyperinsulinemia, hyperandrogenism which exacerbate ovarian dysfunction, anovulation in adolescent girls and these complications will lead to infertility in reproductive age group.[3,4] In 1935 Stein and Leventhal provided first description of PCOS as triad of symptoms like enlarged ovaries, hirsutism, and oligomenorrhoea. Several classification systems have been proposed. According to the Rotterdam criteria, the diagnosis of PCOS in adults requires the presence of any two of the following: (i) clinical or biochemical hyperandrogenism, (ii) ovulatory dysfunction, or (iii) polycystic ovarian morphology on ultrasound. In adolescents, both hyperandrogenism and ovulatory dysfunction are required for diagnosis.[5] PCOS is a significant health concern.[6,7] Apart from ovulatory disorder, infertility, and hyperandrogenism, PCOS is associated with various health risks like metabolic syndrome, diabetes, cardiovascular disease, type 2 diabetes mellitus, endometrial carcinoma, and psychological issues such as depression and anxiety. Thus, PCOS affects adolescent, reproductive, perimenopausal age groups and has adverse health effects in the postmenopausal phase.[8,9]

To prevent long-term cardiometabolic complications, early identification and attention to lifestyle factors, even before individuals enter the reproductive age group, are crucial. This approach enables them to begin their reproductive phase and pregnancy in a eumetabolic state, which supports better fetal programming. To achieve this, collaborative efforts between obstetricians and endocrinologists are required. Considering the growing burden of PCOS as a significant health concern, this study was designed to obtain real-world baseline data from multiple centers and to explore potential regional variability. This cross-sectional study aimed to evaluate clinical presentation, features, associated factors, and metabolic alterations among PCOS patients attending obstetrics and gynecology clinics.

METHODS

Study design

This cross-sectional retrospective, observational study was conducted at five centers in the Vidarbha region of Maharashtra, India, over a duration of one year (January 2022 to January 2023).

Study population, inclusion and exclusion criteria

Female participants visiting clinics with a diagnosis of PCOS-including adolescent girls and infertile women diagnosed by a gynaecologist or reproductive endocrinologist based on established guidelines were included. Participants with other causes of androgen excess and anovulatory infertility, such as hyperprolactinemia and congenital adrenal hyperplasia, or those not meeting inclusion criteria, were excluded from the study.

Data management

A history including clinical, menstrual, reproductive, family, personal, and nutritional aspects was taken. Anthropometric measurements such as BMI, nondominant wrist, neck circumference, and waist-to-hip ratio were recorded. Clinical evaluation focused on signs of pallor, blood pressure, hyperandrogenism (hirsutism, acne, acanthosis nigricans), obesity, and stretch marks. Biochemical and hormonal investigations included CBC, renal and lipid profiles, thyroid function, fasting glucose, insulin, HbA1C, AMH, LH, FSH, prolactin, testosterone, and DHEAS, as available. Ultrasound assessment for polycystic ovarian morphology was performed transabdominally in adolescents and transvaginally in infertile women.

Statistical analysis

Descriptive statistics were presented as mean (standard deviation, SD) or median (interquartile range) based on data distribution. Continuous data were expressed as means with SDs, while categorical data were presented as counts and percentages. Statistical analyses were performed using SPSS version 20.0 (IBM Corp., Armonk, NY, USA) and Microsoft Excel (2019, Microsoft Corporation).

Ethical clearance

This study followed the Indian Council of Medical Research (ICMR) guidelines and adhered to the ethical principles of the Declaration of Helsinki. Approval was obtained from the Independent Ethics Committee. Informed consent was not obtained due to the retrospective nature of the study and the use of anonymized clinical data for analysis.

RESULTS

Data on demographic, reproductive, anthropometric, metabolic, hormonal, biochemical, clinical profiles and ultrasonography were analyzed for the total 309 women in this study.

The mean age of the participants was 23.12 (±5.28) years. The mean age at menarche was 13.16 (±1.55) years Table 1. Among the 309 women, 153 were married, with an average marital duration of 4.21 (±3.66) years and an average duration of trying to conceive of 3.24 (±2.53) years (Table 1). Of 153 participants, around, 56 (36.9%) of women were home makers and 96 (62.74%) were doing job/profession.

Of 153 patients of infertile group, 138 were having primary infertility and 15 had secondary infertility. Most of the participants experienced menarche between ages 11 and 12. Ovulatory dysfunction seen in 232 (75.08%) participants. Secondary amenorrhoea was reported in 5.2% and 1% experienced polymenorrhoea Table 1**.** Majority of participants (97.4%) reported no history of abortion while 2.6% had previous history of abortion. This data suggested that abortions are relatively uncommon in this group.

Table 1: Demographic and reproductive health characteristics of participants.

Age and reproductive health parameters	
Parameter	**Mean (SD), [Range]**
Age (in years)	23.12 (5.280), [14.0-32.0]
Age of menarche (in years)	13.16 (1.554), [9.0-17.0]
Trying for conception since (n=153)	3.24 (2.530), [0.4-11.0]
Marital duration (n=153)	4.21 (3.66) years
Menstrual cycle regularity	**Frequency, N (%)**
Secondary amenorrhea	16 (5.2)
Irregular	172 (55.6)
Polymenorrhea	3 (1.0)
Regular	118 (38.2)
Marital status, occupation and infertility type	
Parameter/category	**Frequency, N (%)**
Marital status	
Married	153 (49.5)
Unmarried	156 (50.5)
Occupation (n=153)	
Homemaker	56 (36.9)
Job/profession	96 (62.7)
Type of infertility (n=153)	
Primary	138 (90.2)
Secondary	15 (9.8)

*Note: N=309, unless otherwise stated

A majority (88.3%) reported normal sleep patterns while 11.0% experienced disturbed sleep. Overall, the family stress (32%) was major contributing factor while workplace stress was reported in 12.0% of participants. The domestic stress was reported in 3.6% of participants.

Almost 50% of participants were leading a moderate lifestyle (49.8%) while around 47.6% of participants had a sedentary lifestyle. Very few participants led heavy (2.6%) lifestyle. Around 55.7% of participants were following a non-vegetarian diet and 43.4% were vegetarians. 59.2% of participant were used to eat thrice a day while 37.2% were used to have food 4 times a day. Only 3.2% were eating food 2 times a day. The frequency of participants having food outside 3 times weekly was reported in majority of participants (41.1%) while 31.1% participants were used to eat outside daily, followed by 20.7% and 2.3% participants were eating outside once a week and only once a month, respectively.

Most participants reported no history of alcohol consumption (96.4%) or smoking (99%). A majority (87.7%) had no associated medical history, Hypothyroidism was present in 3.6%, diabetes in 0.6%, and hypertension in 0.3%, suggesting the presence of a range of reproductive and metabolic conditions among a subset of participants Table 2.

Table 2: Significant associated medical history of patients.

Past medical history	Frequency, N (%)
No significant history	271 (87.7)
Diabetes mellitus (DM)	2 (0.6)
Hypertension (HT)	1 (0.3)
Hypothyroid	11 (3.6)

Table 3: Distribution of BMI of patents.

Category (BMI in kg/m^2)	Frequency, N (%)
Underweight (<18.5)	11 (3.6)
Normal (18.5-22.9)	70 (22.7)
Overweight (23-24.9)	18 (5.8)
Obese (≥25)	210 (67.9)

Table 4: Family history reported (n=309).

	Yes, N (%)	No, N (%)
Family history factor		
PCOS	23 (7.4)	286 (92.6)
Family member with PCOS		
Sister	19 (6.1)	-
Mother	3 (1.0)	-
Mother, sister, GM[a]	1 (0.3)	-
Diabetes mellitus (DM)	67 (21.7)	242 (78.3)
Hypertension (HT)	59 (19.1)	250 (80.9)
Obesity	71 (22.9)	238 (77.1)

[a]GM: Grand Mother

BMI was calculated based on the revised consensus guidelines for India. Using this scale, the total study

population was divided into four groups according to their BMI: <18.5 kg/m^2, 18.5-22.9 kg/m^2, 23-24.9 kg/m^2, and ≥25 kg/m^2 (underweight, normal, overweight, and obese, respectively).[10,11] The mean BMI of this study group was 25.41 (±5.29) kg/m^2. Among the 309 enrolled PCOS patients, 11 (3.6%) were underweight, 18 (5.8%) were overweight, and 210 (67.9%) were obese. The combined proportion of overweight and obese patients was 73.7% (n=228), while 26.3% (n=81) were underweight or normal weight these considered as lean PCOS patients Table 3.

The family history of diseases such as PCOS, diabetes mellitus, hypertension, and obesity were reported. The PCOS was reported in **7**.4% of families, mostly among siblings while diabetes mellitus was present in 21.7% (paternal: 63% and maternal: 37%), hypertension and obesity were found among 19.1% and 22.9% of families Table 4.

The mean neck circumference was 33.65 (±4.01) cm, a parameter positively associated with insulin resistance and metabolic syndrome in women with PCOS. The mean wrist circumference was 16.72 (±2.21) cm. Waist-to-hip ratio (WHR), an important marker for central obesity and insulin resistance, averaged 0.87 (±0.07) in this group. WHR values above 0.8 have been significantly correlated with PCOS and its metabolic and endocrine features.[12] Mean pulse rate was 82.42 (±8.29) bpm, mean systolic blood pressure was 103.41 (±11.60) mmHg, and mean diastolic blood pressure was 72.18 (±9.49) mmHg Table 5.

Table 5: Physical and vital signs measurements.

Parameter	N	Mean (SD), [Range]
Neck circumference (cm)	264	33.65 (4.012), [15.00-55.00]
Wrist circumference (cm)	264	16.72 (2.205), [11.25-22.50]
Waist-hip ratio (WHR)	264	0.87 (0.074), [0.68-1.39]
Pulse rate (bpm)	309	82.42 (8.288), [58-112]
Systolic BP (mmHg)	309	103.41 (11.603), [90-170]
Diastolic BP (mmHg)	309	72.18 (9.493), [50-112]

Among the 309 participants, hyperandrogenism (clinical and/or biochemical) was observed in 143 (46.3%), ovulatory dysfunction in 232 (75.1%), and polycystic ovarian morphology (PCOM) in 156 (50.5%) patients 'Table 6'. The most common clinical features of PCOS were acne (143, 46.3%), acanthosis nigricans (112, 36.2%), and obesity striae (42, 13.6%). The neck was the most frequently affected site for acanthosis nigricans, involved in 87 patients (28.2%), representing approximately 82% of affected sites. Obesity striae were most commonly observed on the abdomen (8, 2.6%) Table 7.

In this infertile group, hyperandrogenism was observed in 56 (36.6%) patients, ovulatory dysfunction in 108 (70.6%), and TVS was performed in 146 patients (95.4%), with polycystic ovarian morphology (PCOM) noted in 124 (81.1%) patients 'Table 8'.

Table 6: Polycystic ovary syndrome signs, symptoms and USG observations as per the Rotterdam's criteria.

Criteria (n=309)	Yes, N (%)
Oligo- or anovulation	232 (75.08)
Hyperandrogenism (Clinical Signs/ Biochemical)	143 (46.28)
PCOM	156 (50.49)

Table 7: Clinical features.

Feature	Yes, N (%)
Acanthosis Nigricans	112 (36.2)
Acne	143 (46.3)
Obesity Striae	42 (13.6)
Change of voice	2 (0.6)

In the adolescent group (n=156), the same criteria were applied except for TVS. Although ultrasonography is not routinely recommended for adolescents by recent PCOS guidelines, abdominal ultrasound (USG) was advised for all as an observational measure. Among adolescents, hyperandrogenism was reported in 87 (55.8%) participants and ovulatory dysfunction in 124 (78.0%). Abdominal USG was performed in 74 (47.4%) adolescents, with 32 (20.51%) showing PCOM 'Table 8'. Phenotype B was more predominant in the adolescent group, whereas phenotype D was more common among infertile women.

Table 8: Hyperandrogenism, ovulation dysfunction, ultrasonography and PCOM in reproductive and adolescent age groups.

Criteria (n=153)	Reproductive age group, N (%)	Adolescent age group, N (%)
Ovulation dysfunction	108 (70.58)	124 (79.49)
Hyperandrogenism	56 (36.60)	87 (55.76)
Ultrasonography performed*	146 (95.42)	74 (47.43)
PCOM	124 (81.05)	32 (20.51)

*Note: Transvaginal sonography was used in the reproductive age group, Abdominal USG in the adolescent group

The mean hemoglobin level of participants was 12.08±1.40 g/dl, indicating generally adequate hemoglobin without signs of severe anemia. Glycemic parameters such as fasting blood sugar (71.2±6.2 mg/dl) and HbA1c (5.55%±0.77) were within normal ranges, suggesting overall good baseline glycemic control. However, fasting insulin was elevated (18.7±26.3

µIU/ml), reflecting insulin resistance commonly observed in PCOS Table 9. Thyroid function tests showed a mean TSH value of 3.0±5.1 µIU/ml, with some participants likely having subclinical hypothyroidism, a condition occasionally associated with PCOS. Kidney and liver function tests were within normal limits. Total protein (7.17±0.67 g/dl) and albumin (4.06±0.49 g/dl) levels indicated adequate nutritional status and liver health Table 9.

Table 9: Hematologic and biochemical parameters.

Parameter (n=250)	Values mean (SD), [Range]
Hemoglobin (g/dl)	12.08 (1.40), [6.29-15.79]
RBC (×10^6/µl)	4.61 (0.86), [3.60-8.10]
Platelets (×10^3/µl)	282.9 (75.7), [156.0-465.0]
Total leukocyte count	7.14 (1.87), [3.76-11.80]
Fasting blood sugar (mg/dl)	71.2 (6.2), [62.8-146.5]
HbA1c (%)	5.55 (0.77), [4.10-8.60]
Random blood glucose (mg/dl)	99.5 (23.3), [57.0-185.0]
Fasting insulin (µIU/ml)	18.7 (26.3), [0.20-159.6]
Postprandial glucose (mg/dl)	127.1 (31.9), [82.0-235.6]
T3 (ng/dl)	28.96 (51.17), [0.77-166.0]
T4 (µg/dl)	9.57 (7.88), [0.88-98.34]
TSH (µIU/ml)	3.0 (5.1), [0.010-124.9]
Serum creatinine (mg/dl)	1.00 (2.11), [0.40-15.7]
Urea (mg/dl)	17.57 (5.95), [1.30-27.80]
Uric acid (mg/dl)	4.58 (3.78), [0.62-24.54]
Total bilirubin (mg/dl)	0.52 (0.24), [0.20-1.13]
Direct bilirubin (mg/dl)	0.17 (0.09), [0.10-0.40]
Indirect bilirubin (mg/dl)	0.30 (0.20), [0.10-0.70]
SGOT (U/l)	26.47 (6.18), [18-44]
SGPT (U/l)	24.47 (13.66), [11-72]
Alkaline phosphatase (U/l)	91.85 (31.19), [44-170]
Total protein (g/dl)	7.17 (0.67), [5.21-8.20]
Albumin (g/dl)	4.06 (0.49), [2.90-4.80]
Globulin (g/dl)	3.16 (0.43), [2.50-3.90]
A/G ratio	1.36 (0.21), [0.97-1.80]
LH (mIU/ml)	8.8 (6.3), [0.23-80.00]
FSH (mIU/ml)	3.8 (1.1), [1.10-42.00]
Prolactin (ng/ml)	18.33 (13.06), [0.48-82.02]
Serum testosterone (ng/ml)	0.45 (0.20), [0.03-327.00]
Serum DHEAS (µg/dl)	182.4 (98.5), [0.55-2603.00]
Free androgen excess	1272.4 (2262.5), [13.71-4663.10]
Total cholesterol (mg/dl)	168.4 (32.1), [102.0-252.0]
HDL cholesterol (mg/dl)	42.87 (11.66), [20.0-70.0]
VLDL (mg/dl)	24.75 (13.95), [10.18-64.80]
HDL ratio	4.19 (1.65), [1.86-9.30]
Triglycerides (mg/dl)	124 (45.3), [50.91-324.0]
LDL cholesterol (mg/dl)	99.81 (30.73), [47.8-182.6]
Non-HDL cholesterol (mg/dl)	116.50 (31.75), [40.0-178.0]
Anti-Mullerian hormone (ng/ml)	5.43 (4.36), [0.01-24.0]

Androgen levels demonstrated mild elevation, with mean serum testosterone at 0.45±0.20 ng/mL and DHEAS at 182.4±98.5 µg/dl. Lipid profile analysis revealed a lower mean HDL cholesterol level (42.87±11.66 mg/dl) and moderately elevated triglycerides (124±45.3 mg/dl), suggesting dyslipidemia consistent with metabolic disturbances in PCOS Table 9.

DISCUSSION

This multicenter study from the Vidarbha region provides an important picture of the clinical spectrum of PCOS among adolescents and women of reproductive age in India. Studies have reported that PCOS affects menstrual function with hyperandrogenism and infertility.[13,14]

Beyond these, it also contributes to metabolic syndrome and psychological distress. Notably, nearly half of our participants were adolescents, underscoring the early onset of symptoms and the importance of timely recognition to avoid further consequences and adverse effects on female health.

Of 309 participants included in this study, 2 most common PCOS groups were adolescent and infertile. They were investigated thoroughly with history and evaluated. Amongst 309 women, the proportion of married 153 (49.5%) and unmarried 156 (50.5%) women was almost equal. The factor which could be responsible was 2 centers had IVF facility while 2 centers had mixed obstetrics and gynecological practice while 1 center belonged to endocrinologist.

Ovulatory dysfunction was the most common abnormality observed in around 75% of women, with irregular cycles reported in over half. This finding is consistent with earlier reports that identify anovulation as the predominant driver of infertility in PCOS, with up to 80% of anovulatory infertility attributable to this syndrome.[15] Our study also highlights that secondary amenorrhea (5.2%) and polymenorrhea (1%), though less common, remain clinically significant subgroups. It indicates potential menstrual health concern in this population. Importantly, almost all women reported no prior history of abortion, suggesting that infertility in this population is primarily linked to ovulatory dysfunction rather than recurrent pregnancy loss. PCOS is associated with 80% of anovulatory infertility.[16] However, the precise mechanism of PCOS-induced anovulation is still undetermined.

In this study, majority of participants reported sedentary (47.6%) or moderately active lifestyles, echoing findings from other Indian cohorts that lifestyle factors strongly exacerbate PCOS manifestations. As per Cochrane database obesity worsens the presentation of PCOS.[17] The weight management is an initial treatment strategy, best achieved through lifestyle changes with proper diet, regular exercise and behavioural interventions.[18] The mean BMI (25.4 kg/m²) and waist–hip ratio (0.87) point toward generalized as well as central adiposity, both of which are well-established risk factors for insulin resistance and metabolic syndrome. The Global evidence suggests that even modest weight loss can significantly restore ovulation and improve metabolic outcomes, underscoring the urgent need for lifestyle interventions in this region.[19]

This indicated that weight gain is a major concern among two third of the population. Those who gained weight, it was over the last 5-6 years in majority of participants. The evidence refers that majority of women with PCOS (38%-88%) are either overweight or obese.[20] Data from the Northern Finland Birth Cohort (NFBC) 1966 showed a significant association between body mass index (BMI) and features of PCOS at all ages.[21] It is vicious cycle between weight-gain, obesity and PCOS. Weight gain and obesity contribute towards the development of PCOS and through various mechanisms the development of PCOS can contribute towards further weight-gain and hamper efforts to establish effective weight-loss.[22] The mean BMI (based on the revised consensus guidelines for India) of our study group was 25.41(±5.29) m^2. BMI is supposed to be an important marker for metabolic syndrome. In a study of Brazilian women with PCOS, the prevalence of metabolic syndrome was found to increase significantly with rising BMI categories 3.2%, 19.2%, and 52.3% for normal, overweight, and obese women, respectively.[23]

The prevalence of hirsutism in PCOS ranges from 70 to 80% vs. 4% to 11% in women in the general population.[24] Incidence of acanthosis nigricans is also more in PCOS.[25] Clinical manifestations such as acne (46%) and acanthosis nigricans (36%) were frequent. The latter is particularly important as a visible marker of insulin resistance, again highlighting the metabolic underpinnings of PCOS. Striae and other dermatological signs, though less frequent, reinforce the multisystem nature of this disorder.

The mean neck circumference in our study group was 33.65 (±4.01). Neck circumference is able to identify IR in women with PCOS with range 33-34.5cm. Neck circumference can be a useful, simple, and practical anthropometric measurement for identifying PCOS women who are at higher risk of IR and MetS.[26,27]

Non-dominant wrist circumference is also a good marker for IR. In PCOS women it can be used as best anthropometric marker.[28] The cut off value for the non-dominant wrist circumference of 16.3cm. It was found to be the best predictor of IR. In this study, mean wrist circumference 16.72 (±2.21) was reported.

Studies support that presence of central obesity, (waist hip ratio >0.87) is an indication for presence of PCOS. In our study group it was 0. 87. Thus, these patients may undergo further hormone evaluation and this simple measurement can help to screen out PCOS from general population.[29-31] Family, past history like PCOS, diabetes in family has significance. In our study, all our values are indicative of obesity as well as IR in the population.

Elevated fasting insulin is a marker of insulin resistance. While not a diagnostic criterion, fasting insulin levels are often elevated in women with PCOS. In this study, though mean fasting glucose (71.2 mg/dL±6.2) and HbA1c (mean: 5.55%±0.77) were within normal ranges, suggesting good baseline glycemic control among participants, fasting insulin levels (18.7 µIU/mL±26.33) were elevated, indicating underlying insulin resistance, a hallmark of PCOS pathophysiology. Dyslipidemia was also evident, with low HDL and borderline high triglycerides in many participants. Together, these findings reflect early metabolic risk in a young cohort and align with international studies linking PCOS to cardiometabolic disorders.[20,32] Serum testosterone and DHEAS were only mildly elevated, suggesting that hyperandrogenism in this group was more moderate

compared to some Western cohorts, potentially reflecting ethnic variation.

In 2023, guidelines for PCOS emphasize the importance of assessing fasting insulin levels as part of evaluating insulin resistance, a key feature of PCOS.[33] Specifically, a fasting insulin level of 9.85 µU/mL or higher is identified as a potential indicator of hyperandrogenism. Studies have shown that women with PCOS tend to have significantly higher fasting insulin levels compared to healthy controls.[31,34] Serum testosterone (mean: 0.45 ng/dL) and DHEAS (mean: 182.4 µg/dL) were slightly elevated but not extreme increase was reported. It could be due to a mild-to-moderate hyperandrogenic state, again one of the PCOS characteristics. A Canadian study work supports that high testosterone mediating risk of PCOS.[35] Our findings for HDL cholesterol (mean: 42.87 mg/dL) was at lower side while triglycerides (mean: 124 mg/dL) levels were somewhat elevated, which could suggest a risk of metabolic syndrome.

According to the 2023 international evidence-based guidelines for the assessment and management, 4 phenotypes of PCOS are suggested and they are classified on the presence of at least two out of three criteria: Oligo-/anovulation (OA) i.e. Ovulatory Dysfunction (OD), Clinical or Biochemical Hyperandrogenism (HA) and Polycystic Ovarian Morphology (PCOM) on ultrasound or elevated AMH levels.[33] With these criteria four phenotypes of PCOS are described. Phenotype A (HA+OD+PCOM), Phenotype B (HA+OD), Phenotype C (HA+PCOM), Phenotype D (OD+PCOM). Studies suggest race and ethnicity-specific factors related to PCOS must be considered in clinical practice to avoid missing out PCOS patients in that specific region.[36] In this study, type B phenotype in adolescent group was more common and type D phenotype in infertile group was more common.

The major strength of our study lies in its focus on two key groups-adolescents and infertile women with PCOS. The findings may help inform interventions or policy planning targeting adolescents. Proper counselling and management of PCOS can prevent complications during the reproductive phase and reduce risks of metabolic disorders.

Additionally, all five centers used a standardized instruction proforma and equipment with similar specifications, ensuring accuracy and reliable quality of all measurements.

The study has several limitations. First, it is a retrospective observational study, which may lead to data gaps. Second, lack of control over how and when clinical measurements and assessments were originally performed could introduce measurement bias. Third, the participants are exclusively from the Vidarbha region of India, which may limit the generalizability of the findings to the entire country. However, cultural and dietary practices in Vidarbha vary somewhat due to a floating population from across India.

CONCLUSION

This study reinforces that PCOS is not only a reproductive disorder but also a metabolic condition with early onset and long-term implications. It is characterised by early onset, high rates of ovulatory dysfunction, obesity, insulin resistance, and metabolic risk factors. Age-specific phenotypic differences highlight the evolving nature of the disorder across the life course. Comprehensive management must therefore extend beyond symptom control to include lifestyle modification, metabolic screening, and psychological support. Special attention is required for adolescents to ensure timely diagnosis, appropriate counselling, and prevention of long-term sequelae.

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