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Clinical and Metabolic Characteristics of Women with Polycystic Ovary Syndrome Attending a Tertiary Care Hospital in Bihar: A Cross-Sectional Study

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ABSTRACT

Background: Polycystic ovary syndrome (PCOS) is a common endocrine disorder with significant reproductive and metabolic implications. Data from Tier 2 cities in India remain limited, particularly regarding the interplay between clinical features and metabolic abnormalities.
Objectives: To assess the clinical and metabolic profile of women with PCOS and to evaluate the association between body mass index (BMI) and metabolic syndrome.
Methods: A hospital-based cross-sectional study was conducted among 236 women diagnosed with PCOS using the Rotterdam criteria (2003) at a tertiary care hospital in Bihar from April to November 2024. Sociodemographic details, clinical features, anthropometric measurements, and biochemical parameters including fasting blood glucose and lipid profile were recorded. Metabolic syndrome was defined using ATP III criteria. Data were analyzed using descriptive statistics and Chi-square test, with $p < 0.05$ considered statistically significant.
Results: The mean age of participants was 24.8 ± 4.6 years. Menstrual irregularities were present in 83.9%, followed by hirsutism (61.9%) and acne (55.9%). Obesity was observed in 48.3%, and central obesity in 61.0% of participants. Impaired fasting glucose or diabetes was noted in 31.4%, while dyslipidemia was common, with low HDL (55.9%) and elevated triglycerides (45.8%). Metabolic syndrome was present in 40.7% of participants. A significant association was observed between BMI and metabolic syndrome ($\chi^2 = 24.6$, $p < 0.001$), with higher prevalence among obese individuals.
Conclusion: PCOS is associated with a high burden of metabolic abnormalities even in young women. Early identification and targeted interventions focusing on weight management and metabolic screening are essential to reduce long-term health risks.

Keywords: *PCOS; Metabolic Syndrome; Insulin Resistance; Obesity; Bihar.*

INTRODUCTION

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders affecting women of reproductive age and is increasingly recognized as a major contributor to both reproductive and metabolic morbidity. It is characterized by a heterogeneous spectrum of clinical features, including chronic anovulation, hyperandrogenism, and polycystic ovarian morphology [1]. In addition to menstrual irregularities and infertility, PCOS is associated with a range of metabolic disturbances that significantly impact long-term health outcomes.

The global prevalence of PCOS varies between 4% and 20%, depending on the diagnostic criteria and population studied [2]. In India, the prevalence is estimated to range from 11% to 19%, with a rising trend attributed to rapid urbanization,

lifestyle transitions, and increasing awareness [3,4]. However, most available data are derived from metropolitan regions, while evidence from semi-urban and Tier 2 settings remains limited. Sociocultural factors, healthcare access, and lifestyle patterns in such regions may influence both clinical presentation and metabolic risk, underscoring the need for region-specific data [5].

The Rotterdam criteria (2003) remain the most widely accepted diagnostic standard for PCOS, requiring the presence of at least two of the following features: oligo- or anovulation, clinical or biochemical hyperandrogenism, and polycystic ovarian morphology on ultrasonography [6]. This broadened definition captures a diverse range of phenotypes with varying clinical severity and metabolic implications, making comprehensive clinical and metabolic assessment essential.

Insulin resistance plays a central role in the pathophysiology of PCOS and links reproductive dysfunction with metabolic abnormalities. Hyperinsulinemia enhances ovarian androgen production and disrupts follicular maturation, thereby contributing to menstrual irregularities and hyperandrogenic manifestations such as hirsutism and acne [7]. At the same time, insulin resistance predisposes individuals to impaired glucose metabolism and dyslipidemia, forming the basis for increased cardiometabolic risk [8].

Obesity, particularly central obesity, is a common and significant contributor to the metabolic burden in PCOS. Excess adiposity exacerbates insulin resistance and hormonal imbalance, further worsening both clinical and biochemical manifestations [9]. South Asian populations are known to have a higher propensity for central fat distribution and metabolic complications even at lower body mass index (BMI) levels, making this association particularly relevant in the Indian context [10].

Women with PCOS are also at an increased risk of developing metabolic syndrome, a cluster of interrelated risk factors including central obesity, hypertension, hyperglycemia, and dyslipidemia. The coexistence of these abnormalities substantially elevates the risk of future cardiovascular disease and type 2 diabetes mellitus. Importantly, these metabolic derangements may be present even in young women, highlighting the need for early detection and intervention.

Despite growing recognition of PCOS as a metabolic disorder, there is limited data from eastern India, particularly from Tier 2 cities, where differences in lifestyle, healthcare accessibility, and awareness may influence disease patterns. Moreover, understanding the relationship between clinical manifestations and metabolic abnormalities is crucial for identifying high-risk individuals and optimizing management strategies.

In this context, the present study was conducted to assess the clinical and metabolic profile of women diagnosed with PCOS attending a tertiary care hospital in a Tier 2 city in Bihar. Additionally, the study aimed to evaluate the association between anthropometric parameters, particularly BMI, and metabolic syndrome, thereby providing region-specific evidence to guide early screening and comprehensive management of PCOS.

METHODOLOGY

Study Design and Setting: This hospital-based cross-sectional study was conducted in the Department of Obstetrics and Gynecology of a tertiary care teaching hospital located in a Tier 2 city in Bihar, India.

Study Duration: The study was carried out over a period of eight months, from April 2024 to November 2024.

Study Population: The study included women of reproductive age attending the outpatient and inpatient departments who were diagnosed with polycystic ovary syndrome (PCOS).

Sample Size and Sampling Technique: A total of 236 participants were included in the study. Participants were recruited using a consecutive sampling technique, wherein all eligible women presenting during the study period and fulfilling the inclusion criteria were enrolled until the desired sample size was achieved.

Inclusion Criteria

1. Women aged 15–45 years
2. Diagnosed with PCOS based on the Rotterdam criteria (2003), requiring at least two of the following:
    1. Oligo- or anovulation
    2. Clinical hyperandrogenism (hirsutism/acne)
    3. Polycystic ovarian morphology on ultrasonography

Exclusion Criteria

- Known thyroid disorders
- Hyperprolactinemia
- Cushing's syndrome

- Congenital adrenal hyperplasia
- Pregnant women
- Women on medications affecting hormonal or metabolic parameters

Data Collection Procedure: Data were collected using a pre-tested semi-structured questionnaire, clinical examination, and relevant biochemical investigations.

Sociodemographic Variables

- Age
- Residence (urban/rural)
- Socioeconomic status

Clinical Assessment

- Menstrual history (regular/irregular cycles)
- Hirsutism (assessed clinically)
- Acne
- Acanthosis nigricans
- History of infertility
- Blood pressure measurement

Anthropometric Measurements

- Height and weight were measured using standard procedures, and Body Mass Index (BMI) was calculated as weight (kg)/height (m^2)
- Waist circumference was measured to assess central obesity

Biochemical Assessment: After overnight fasting, venous blood samples were collected and analyzed for:

- **Fasting blood glucose (FBG)**
- **Lipid profile**, including total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), and triglycerides

Operational Definitions

- **BMI Classification (Asian cut-offs):**
  - Normal: <23 kg/m^2
  - Overweight: 23–24.9 kg/m^2
  - Obese: ≥25 kg/m^2
- **Central Obesity:**
  - Waist circumference ≥80 cm (females)
- **Hypertension:**
  - Blood pressure ≥140/90 mmHg or previously diagnosed
- **Impaired Fasting Glucose/Diabetes:**
  - Fasting blood glucose ≥100 mg/dL
- **Dyslipidemia:**
  - Triglycerides ≥150 mg/dL
  - HDL <50 mg/dL
  - LDL ≥130 mg/dL
- **Metabolic Syndrome:**

  Defined using Adult Treatment Panel III (ATP III) criteria, requiring ≥3 of the following:
  - Central obesity
  - Elevated triglycerides
  - Reduced HDL cholesterol
  - Elevated blood pressure
  - Elevated fasting glucose

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics like continuous variables were expressed as mean ±standard deviation (SD). Categorical variables were presented as frequencies and percentages Inferential statistics like Chi-square test was used to assess associations between categorical variables. Fisher's exact test was applied where expected cell counts were <5. A p-value < 0.05 was considered statistically significant.

Ethical Considerations: Written informed consent was obtained from all participants prior to enrollment. Confidentiality and anonymity of participants were strictly maintained.

RESULTS

A total of 236 women diagnosed with PCOS were included in the study. The mean age of participants was 24.8 ±4.6 years, with the majority belonging to the 20–24 years (39.0%) and 25–29 years (27.1%) age groups. Most participants were from urban areas (60.2%), and over half belonged to the middle socioeconomic class (52.5%).(Table 1)

Table 1: Sociodemographic Characteristics of Study Participants (n = 236)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	<20	38	16.1
	20–24	92	39.0
	25–29	64	27.1
	≥30	42	17.8
Residence	Urban	142	60.2
	Rural	94	39.8
Socioeconomic Status	Lower	68	28.8
	Middle	124	52.5
	Upper	44	18.6

Menstrual irregularities were the most common clinical presentation, observed in 83.9% of participants. Other clinical features included hirsutism (61.9%), acne (55.9%), and acanthosis nigricans (37.3%). Infertility was reported by 30.5% of women.(Table 2)

Table 2: Clinical Profile of PCOS Participants (n = 236)

Clinical Feature	Frequency (n)	Percentage (%)
Menstrual irregularities	198	83.9
Hirsutism	146	61.9
Acne	132	55.9
Infertility	72	30.5
Acanthosis nigricans	88	37.3

Anthropometric assessment revealed that 48.3% of participants were obese and 24.6% were overweight, while only 27.1% had normal BMI. Central obesity was present in 61.0% of participants, and 25.4% were hypertensive. (Table 3)

Table 3: Anthropometric and Blood Pressure Profile (n = 236)

Parameter	Category	Frequency (n)	Percentage (%)
BMI (kg/m²)	Normal (<23)	64	27.1
	Overweight (23–24.9)	58	24.6
	Obese (≥25)	114	48.3
Waist Circumference	Normal	92	39.0
	Central obesity	144	61.0
Blood Pressure	Normal	176	74.6

	Hypertensive	60	25.4

Metabolic evaluation showed that 31.4% of participants had impaired fasting glucose or diabetes. Dyslipidemia was highly prevalent, with 45.8% having elevated triglycerides, 55.9% having low HDL cholesterol, and 50.0% showing elevated LDL cholesterol levels.(Table 4)

Table 4: Metabolic Profile of Participants (n = 236)

Parameter	Category	Frequency (n)	Percentage (%)
Fasting Blood Glucose	Normal	162	68.6
	Impaired/Diabetic	74	31.4
Triglycerides	Normal	128	54.2
	Elevated	108	45.8
HDL Cholesterol	Normal	104	44.1
	Low	132	55.9
LDL Cholesterol	Normal	118	50.0
	Elevated	118	50.0

Based on ATP III criteria, 40.7% of participants were found to have metabolic syndrome, indicating a substantial burden of cardiometabolic risk.(Table 5)

Table 5: Prevalence of Metabolic Syndrome (n = 236)

Variable	Frequency (n)	Percentage (%)
Metabolic Syndrome Present	96	40.7
Metabolic Syndrome Absent	140	59.3

A statistically significant association was observed between BMI and metabolic syndrome. The prevalence of metabolic syndrome increased progressively with increasing BMI, being highest among obese participants (56.1%) compared to overweight (34.5%) and normal BMI groups (18.8%) ($\chi^2 = 24.6$, $p < 0.001$).(Table 6)

Table 6: Association Between BMI and Metabolic Syndrome

BMI Category	Metabolic Syndrome Present n (%)	Metabolic Syndrome Absent n (%)	χ^2 Value	p-value
Normal	12 (18.8)	52 (81.2)	**24.6**	**<0.001**
Overweight	20 (34.5)	38 (65.5)		
Obese	64 (56.1)	50 (43.9)		

DISCUSSION

The present study provides a comprehensive assessment of the clinical and metabolic profile of women with PCOS in a Tier 2 city setting, highlighting a substantial burden of both reproductive and metabolic abnormalities. The majority of participants were young women in their third decade of life, which is consistent with the known epidemiological pattern of PCOS being most commonly diagnosed during early reproductive years [11]. Similar age distributions have been reported in Indian studies, reflecting increasing awareness and healthcare utilization among younger women [12].

Menstrual irregularities were the most common clinical manifestation in the present study, observed in 83.9% of participants. This finding is in accordance with previous literature identifying ovulatory dysfunction as a cardinal feature of PCOS [13]. Hyperandrogenic manifestations such as hirsutism (61.9%) and acne (55.9%) were also highly prevalent,

comparable to findings from other Indian cohorts [14]. Additionally, acanthosis nigricans was present in more than one-third of participants, indicating underlying insulin resistance, which is a well-established pathophysiological hallmark of PCOS [15].

A key finding of this study is the high prevalence of overweight and obesity, with approximately three-fourths of participants having elevated BMI. Nearly half of the study population was classified as obese, which is consistent with previous studies highlighting the strong association between PCOS and obesity, particularly in South Asian populations [16]. Central obesity, observed in 61% of participants, is of particular concern as it is closely linked to insulin resistance and adverse metabolic outcomes. Previous research has demonstrated that abdominal adiposity plays a critical role in exacerbating both metabolic and reproductive dysfunction in PCOS [17].

The metabolic profile observed in this study reveals a significant burden of dysglycemia and dyslipidemia. Approximately one-third of participants had impaired fasting glucose or diabetes, which aligns with prior studies reporting increased prevalence of glucose intolerance among women with PCOS [18]. Dyslipidemia was also highly prevalent, particularly low HDL cholesterol (55.9%) and elevated triglycerides (45.8%), reflecting an atherogenic lipid profile commonly described in PCOS populations [19]. These findings emphasize the importance of routine metabolic screening in women with PCOS, even at a young age.

The prevalence of metabolic syndrome in the present study was 40.7%, which is comparable to previously reported estimates ranging from 30% to 50% among women with PCOS [20]. This high prevalence indicates a clustering of cardiometabolic risk factors in this population. The presence of metabolic syndrome significantly increases the risk of long-term complications, including type 2 diabetes mellitus and cardiovascular disease, thereby necessitating early identification and intervention [21].

A statistically significant association was observed between BMI and metabolic syndrome, with a progressive increase in prevalence across BMI categories. More than half of the obese participants had metabolic syndrome compared to significantly lower proportions in overweight and normal BMI groups. This finding is consistent with earlier studies demonstrating that obesity is a major determinant of metabolic risk in PCOS [22]. Obese women with PCOS are known to exhibit greater insulin resistance, more severe metabolic abnormalities, and poorer clinical outcomes compared to their lean counterparts [23]. This reinforces the central role of weight management in mitigating metabolic risk in PCOS.

The findings of this study are particularly relevant in the context of a Tier 2 city, where rapid lifestyle transitions, including reduced physical activity and dietary changes, may contribute to the rising burden of PCOS and associated metabolic disorders. Additionally, limited awareness and delayed health-seeking behavior in such settings may lead to underdiagnosis or late presentation. Therefore, region-specific data such as ours are essential for guiding targeted screening strategies and public health interventions.

Overall, the present study highlights the dual burden of reproductive and metabolic abnormalities in women with PCOS and underscores the need for an integrated approach to management. Routine assessment of metabolic parameters, early lifestyle modification, and patient education should be prioritized, particularly in semi-urban and resource-limited settings.

CONCLUSION

The present study highlights a substantial burden of both clinical and metabolic abnormalities among women with polycystic ovary syndrome in a Tier 2 city setting. Menstrual irregularities and hyperandrogenic features were highly prevalent, reflecting the significant reproductive impact of the disorder. Importantly, a large proportion of participants exhibited obesity, central adiposity, dyslipidemia, and impaired glucose metabolism, with over two-fifths fulfilling the criteria for metabolic syndrome. The strong association observed between body mass index and metabolic syndrome underscores the pivotal role of obesity in amplifying metabolic risk in PCOS. These findings emphasize that PCOS is not merely a reproductive disorder but a multisystem condition with early cardiometabolic implications. Routine metabolic screening, early lifestyle interventions, and targeted risk stratification should be integral to the management of PCOS, particularly in semi-urban and resource-limited settings. Region-specific evidence such as this is crucial for guiding comprehensive and contextually relevant healthcare strategies.

DECLARATIONS

Consent to Participate: Written informed consent was obtained from all participants prior to enrollment.

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Conflict of Interest: The authors declare no conflict of interest.
Availability of Data: Data are available from the corresponding author on reasonable request.

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