

RISK FACTORS FOR POLYCYSTIC OVARIAN SYNDROME AND ITS COMPLICATIONS AMONG PCOS PATIENTS ATTENDING TERTIARY HEALTH CARE FACILITY – A CROSS SECTIONAL STUDY

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ABSTRACT

Background: Polycystic ovarian syndrome (PCOS) is a common endocrine disorder with major reproductive, metabolic, and psychological consequences. Data on risk factors and complications among rural, low-income women attending public tertiary care in India remain limited. This study is aimed to estimate the prevalence of key risk factors and complications of PCOS and examine their associations with socio-demographic characteristics. **Materials and Methods:** This hospital-based cross-sectional study included 70 women aged 14–45 years with gynecologist-confirmed PCOS, attending a tertiary care facility in Eluru district, Andhra Pradesh. Data were collected using a pre-tested questionnaire. Associations were analysed using Chi-square, Fisher's exact, and Mann-Whitney U tests, wherever applicable. **Results:** Seventy women with PCOS (mean age 26.7 ± 8.9 years) participated; 85.7% were rural and 91.4% belonged to lower socioeconomic strata. Irregular menstrual cycles (72.9%), heavy bleeding (52.9%), infertility (31.4%), and psychological symptoms (40.0%) were common. Lifestyle risks were high, with 74.3% rarely exercising and 35.7% sedentary. Overweight/obesity affected 70.0% with central obesity. Diabetes mellitus and hypertension were present in 11.4% and 12.9% of participants, respectively. Older age was significantly associated with diabetes, sleep apnoea, and psychological symptoms. Rural women had higher odds of irregular menstrual cycles (OR 5.60). No significant associations were found between BMI or physical activity and major complications (all $p > 0.05$). **Conclusion:** Women with PCOS attending public tertiary care carry burden of modifiable risk factors and complications. Socio-demographic factors showed important associations with specific outcomes, highlighting the need for targeted interventions in public health settings.

INTRODUCTION

Polycystic ovarian syndrome (PCOS) ranks among the most frequent endocrine disorders in women of reproductive age and poses a major clinical and public health concern globally. The condition presents with a varied mix of reproductive, metabolic, and psychological features, such as irregular periods, signs of excess androgens, obesity, insulin resistance, infertility, and increased long-term risk of cardiometabolic disease. Because of its

complex causes and diverse clinical picture, PCOS often proves difficult to diagnose and manage.^[1]

Worldwide, PCOS affects a large number of women, though reported prevalence varies depending on the diagnostic criteria and population studied. The World Health Organization estimated that around 116 million women were living with PCOS in 2012,^[2] while systematic reviews have placed the pooled prevalence between 5% and 12%, with higher rates noted in some ethnic groups and regions.^[3-5]

Researchers now view PCOS as a disorder shaped by genetic predisposition, environmental factors, lifestyle choices, and disruptions in neuroendocrine and metabolic pathways. Insulin resistance plays a central role, driving hyperinsulinemia that in turn promotes hyperandrogenism and worsens both reproductive and metabolic problems.^[6-8] Obesity, especially central obesity, intensifies insulin resistance and increases the severity of PCOS, raising the chances of type 2 diabetes, hypertension, dyslipidemia, and cardiovascular disease.^[9]

In clinical practice, women with PCOS commonly report menstrual irregularities, hirsutism, acne, and infertility.^[10] Many also experience psychological difficulties, including anxiety and depression, which can greatly affect quality of life.^[11] In India, prevalence figures range from 3.7% to 22.5%, showing clear differences across diagnostic criteria, age groups, and urban–rural settings.^[12-14] Despite the high burden, few studies have looked closely at risk factors, socio-demographic patterns, and complications in rural and low-income communities. Such information is essential for designing targeted prevention programs, improving early detection, and reducing long-term harm.

Given the scarcity of data from women attending public tertiary facilities, we carried out this study to document the risk factors and complications for PCOS, explore their associations with socio-demographic variables.

MATERIALS AND METHODS

Study design

A hospital-based cross-sectional study to determine the prevalence of risk factors and complications of PCOS, and their socio-demographic associations.

Study setting

Gynaecology Department of a tertiary health care facility in Eluru district, Andhra Pradesh, India.

Study period

Data collection spanned 3 months, from March 2026 to May 2026.

Study population

All women diagnosed with PCOS who attended the gynaecology outpatient department during the study period formed the study population.

Sample size and sampling technique

We enrolled 70 women with gynecologist-confirmed PCOS. Consecutive sampling was used, so every eligible and consenting patient who visited the outpatient department during the study period was invited to participate.

Eligibility criteria

Inclusion Criteria

- Women aged 14–45 years
- Diagnosed with PCOS by a gynecologist according to standard clinical criteria

- Willing to participate and able to give written informed consent/assent forms.

Exclusion Criteria

- Women with other known causes of hyperandrogenism
- Patients with ovarian or other malignancies
- Patients with known cardiovascular disease or severe systemic illness
- Patients with severe psychiatric disorders

Study variables

Age, residence, education, occupation, Age at menarche, age at marriage, menstrual regularity and frequency, Physical activity, dietary pattern, waist-to-hip ratio, etc.

Data collection methods: Trained interviewers collected information using a pre-designed and pre-tested semi-structured questionnaire after obtaining written informed consent.

Operational definitions

- PCOS: Diagnosis confirmed by a gynecologist using accepted clinical criteria.
- Overweight and obesity: Defined according to WHO BMI categories.
- Lifestyle, Dietary patterns, and Physical activity: Self-reported
- Infertility: Inability to conceive after at least one year of regular unprotected intercourse.

Ethical considerations

The Institutional Ethics Committee clearance was obtained (IEC: 034-2026). All participants gave written informed consent before enrolment, along with assent forms by females less than 18 years with consent from their parents/guardians. We maintained strict confidentiality and anonymity throughout.

Statistical analysis

Data were entered into Microsoft Excel and analysed with SPSS version 20. We summarised continuous variables as mean $\pm$ standard deviation and categorical variables as frequencies and percentages. Associations were analysed using Chi-square, Fisher's exact, and Mann-Whitney U tests, wherever applicable. A p-value less than 0.05 was considered statistically significant.

RESULTS

Study population and socio-demographic characteristics

Seventy women with a gynecologist-confirmed diagnosis of PCOS who attended the Gynaecology Outpatient Department of a tertiary hospital in Eluru district, Andhra Pradesh, participated in the study. Their mean age was 26.7 ± 8.9 years (range 14–45 years). The large majority (85.7%) lived in rural areas. Half were housewives (50.0%), and 25.7% were students. Most had completed education up to the intermediate level (40.0%). (Table 1).

Table 1: Socio-demographic characteristics of study participants (n = 70)

Variable	Category	n	%
Residence	Rural	60	85.7
	Urban	10	14.3
Age (years)	Mean $\pm$ SD	26.7 $\pm$ 8.9	—
Occupation	Housewife	35	50.0
	Student	18	25.7
	Others	17	24.3
Education	Up to Intermediate	28	40.0
	Degree	14	20.0
	Others	28	40.0

Reproductive and menstrual characteristics

Seventy-one percent of the women were married, with a mean age at marriage of 19.5 ± 4.2 years. Mean age at menarche was 12.4 ± 1.4 years. Menstrual

problems were very common: 72.9% had irregular cycles (typically 6–8 cycles per year) and 52.9% reported heavy bleeding. Infertility or difficulty conceiving was noted by 31.4% (Table 2).

Table 2: Reproductive and menstrual characteristics (n = 70)

Variable	Value
Married	50 (71.4%)
Age at marriage (years), mean $\pm$ SD	19.5 ± 4.2
Age at menarche (years), mean $\pm$ SD	12.4 ± 1.4
Irregular menstrual cycles	51 (72.9%)
Typical cycle frequency (affected)	6–8 cycles/year
Heavy menstrual bleeding	37 (52.9%)
Pad usage/day, mean $\pm$ SD	3.6 ± 1.8
Women with children	38 (54.3%)
Number of children, mean $\pm$ SD	1.2 ± 1.0
Infertility / difficulty conceiving	22 (31.4%)

Prevalence of risk factors

Lifestyle and dietary factors: Many participants reported modifiable lifestyle patterns. Seventy-four percent exercised rarely or never, and 35.7% described their daily routine as sedentary. Diets were

mainly high in carbohydrates (58.6%) or fats (30.0%), with most women eating a mixed diet (94.3%). Coffee or tea consumption was common (65.2%), while smoking was absent and alcohol intake very rare (1.4%) (Table 3).

Table 3: Lifestyle and dietary risk factors (n = 70)

Factor	Category	n	%
Physical activity	Rare/None	52	74.3
	Daily	10	14.3
	$\geq$ Once/week	8	11.4
Diet pattern	High carbohydrate	41	58.6
	High fat	21	30.0
	Balanced	6	8.6
Diet type	Mixed	66	94.3
Lifestyle pattern	Sedentary	25	35.7
	Moderate working	45	64.3
Coffee/Tea consumption	Yes	46	65.2
Smoking	Yes	0	0.0
Alcohol intake	Yes	1	1.4

Anthropometric profile Mean BMI was 28.1 ± 6.2 kg/m². Overweight and obesity together affected 70.0% of the women (34.3% overweight, 35.7% obese). The mean waist-to-hip ratio of 0.92 ± 0.08 indicated widespread central obesity (Table 4).

Table 4. Anthropometric measurements and BMI distribution (n = 70)**Table 4A: Anthropometric measurements**

Parameter	Mean $\pm$ SD	Range
Height (cm)	154 ± 6.5	140–167
Weight (kg)	67.6 ± 14.2	30–110
BMI (kg/m ²)	28.1 ± 6.2	16.2–44.4
Waist-to-hip ratio	0.92 ± 0.08	0.78–1.10

Table 4B: BMI categories

BMI category	n	%
Underweight (<18.5)	4	5.7
Normal (18.5–24.9)	17	24.3
Overweight (25–29.9)	24	34.3
Obese (≥ 30)	25	35.7
Overweight/Obese combined	49	70.0

Distribution of PCOS-related symptoms and complications

The most frequent symptoms were irregular menstrual cycles (72.9%), hair loss or thinning (60.0%), pelvic pain (55.7%), and difficulty losing

weight (54.3%). Features linked to hyperandrogenism and insulin resistance included acanthosis nigricans (37.1%), severe acne (30.0%), and hirsutism (28.6%). A history of anemia was reported by 38.6%, mostly mild (Tables 5 and 6).

Table 5: Prevalence of PCOS-related symptoms (n = 70)

Symptom / Indicator	n	%
Irregular menstrual cycles	51	72.9
Heavy menstrual bleeding	37	52.9
Hair loss / thinning	42	60.0
Pelvic pain	39	55.7
Weight gain / difficulty losing	38	54.3
Acanthosis nigricans	26	37.1
Severe acne	21	30.0
Hirsutism	20	28.6
Infertility	22	31.4
History of anemia	27	38.6

Table 6: Severity of anemia among affected participants (n = 27)

Severity	n	%
Mild	16	60.0
Moderate	8	30.0
Severe	3	10.0

Family history and complications

Only 2.9% reported a family history of PCOS, yet family history of diabetes (34.3%) and obesity (25.7%) was common (Table 7). Current

complications included diabetes mellitus (11.4%), hypertension (12.9%), sleep apnoea (4.3%), and stress, anxiety or depression (40.0%) (Table 8).

Table 7: Family history (n = 70)

Condition	n	%
PCOS	2	2.9
Diabetes mellitus	24	34.3
Obesity	18	25.7
Cancer	4	5.7

Table 8: Complications (n = 70)

Complication	n	%
Diabetes mellitus	8	11.4
Hypertension	9	12.9
Sleep apnoea	3	4.3
Stress/Anxiety/Depression	28	40.0

Treatment history One-quarter of the women (25.7%) had used oral contraceptive pills.

Associations of socio-demographic factors with PCOS risk factors and complications

We examined associations of age, residence, and occupation with key PCOS risk factors/symptoms and complications using the Mann-Whitney U test, Fisher's exact test, or Chi-square test as appropriate. Only statistically significant findings ($p < 0.05$) are presented below.

Age-related findings (Table 9): Older age was significantly associated with personal history of diabetes, sleep apnoea, symptoms of stress/anxiety/depression, and history of oral contraceptive pill use. These findings suggest that metabolic, respiratory, and psychological complications tend to increase with advancing age in women with PCOS. Conversely, sedentary lifestyle was more common among younger participants.

Table 9: Factors significantly associated with age (Mann-Whitney U test)

Factor / Complication	Yes (n)	Mean Age Yes (years)	Mean Age No (years)	U statistic	p-value	Direction
Personal history of diabetes	9	34.9 ± 11.0	25.5 ± 7.7	406.5	0.015	More in Older
Sleep apnoea	3	31.4 ± 7.9	26.0 ± 8.6	-	0.044	More in Older
Stress / anxiety / depression	26	29.1 ± 9.0	25.1 ± 8.3	707.5	0.042	More in Older
History of birth control pill use	16	30.9 ± 8.2	25.5 ± 8.6	580.5	0.018	More in Older
Sedentary lifestyle	25	23.7 ± 7.2	28.4 ± 9.1	-	0.016	More in Younger

Note: No significant association with age was found for irregular menstrual cycles, heavy bleeding, hirsutism, hair loss, severe acne, acanthosis nigricans, weight gain/difficulty losing weight, pelvic pain, hypertension, infertility, or anemia (all $p > 0.05$).

Residence-related findings (Table 10): Rural women had significantly higher odds of irregular

menstrual cycles compared with urban women (OR 5.60). In contrast, sedentary lifestyle was significantly more prevalent among urban participants. These differences may reflect variations in lifestyle, physical activity patterns, or healthcare-seeking behaviour between rural and urban settings.

Table 10: Factors significantly associated with residence (Fisher's exact test)

Factor	Rural Yes % (n/N)	Urban Yes % (n/N)	Odds Ratio (95% CI)	p-value	Direction
Irregular menstrual cycles	80.0% (44/55)	41.7% (5/12)	5.60 (1.49 – 21.05)	0.012	Higher in Rural
Sedentary lifestyle	30.9% (17/55)	66.7% (8/12)	0.22 (0.06 – 0.82)	0.047	Higher in Urban

Note: No significant rural–urban differences were observed for heavy bleeding, hirsutism, hair loss, acne, acanthosis nigricans, weight gain difficulty, pelvic pain, diabetes, hypertension, infertility, stress/anxiety/depression, OCP use, or anemia (all $p > 0.05$).

Occupation-related findings (Table 11): Both infertility and history of oral contraceptive pill use were significantly more common among housewives than among students and employed women. These associations are likely confounded by age and marital status, as housewives in this study tended to be older and more likely to be married.

Table 11: Factors significantly associated with occupation (Chi-square / Fisher's exact test)

Factor	Housewife % (n/N)	Student % (n/N)	Employed % (n/N)	χ^2 (df)	p-value	Direction
Infertility / difficulty conceiving	50.0% (18/36)	6.7% (1/15)	9.1% (1/11)	12.38 (df=2)	0.002	Higher in Housewives
History of birth control pill use	38.9% (14/36)	5.6% (1/18)	18.2% (2/11)	7.34 (df=2)	0.026	Higher in Housewives

Note: No significant differences across occupation groups were found for irregular cycles, heavy bleeding, hirsutism, hair loss, acne, acanthosis nigricans, weight gain difficulty, pelvic pain, diabetes, hypertension, sleep apnoea, stress/anxiety/depression, or anemia (all $p > 0.05$). No statistically significant associations were found between BMI category or physical activity level and the major complications (diabetes, hypertension, infertility) or between menstrual irregularity and infertility (all $p > 0.05$).

DISCUSSION

In this hospital-based cross-sectional study of 70 women with PCOS attending a tertiary care centre in Eluru district, Andhra Pradesh, we documented a substantial burden of modifiable lifestyle risk factors, central obesity, reproductive difficulties, metabolic complications, and psychological distress, predominantly among women from lower socioeconomic backgrounds. These findings add important context to the clinical picture of PCOS in an under-represented rural Indian population and underscore the need for targeted preventive strategies within public health systems.

The socio-demographic profile of our participants — overwhelmingly rural (85.7%) and from lower socioeconomic strata (91.4% holding white ration

cards) — differs markedly from most previous Indian studies, which have largely focused on urban or college-based populations.^[12,13] This rural, low-income focus is a key strength of our work and addresses a recognised gap in the literature.^[14] Lifestyle risks were highly prevalent: nearly three-quarters of women (74.3%) exercised rarely or never, more than one-third (35.7%) led sedentary lives, and the majority consumed diets high in carbohydrates (58.6%). These behaviours were reflected in the high rate of overweight/obesity (70.0%) and central obesity (mean waist-to-hip ratio 0.92), consistent with the well-established role of insulin resistance and obesity in amplifying PCOS severity.^[9] Our obesity prevalence is higher than that reported in some community-based studies,^[4,5] but comparable to clinic-based Indian cohorts described by Ganie et al.^[14]

Reproductive complaints were frequent and aligned with patterns reported in other Indian studies. Irregular menstrual cycles affected almost three-quarters of participants (72.9%), a figure consistent with the high rates of anovulatory cycles described in the Rotterdam consensus and in Indian clinic-based data.^[10,14] Heavy menstrual bleeding (52.9%) and infertility (31.4%) were also common, reflecting the significant reproductive burden of PCOS in this population. Signs of hyperandrogenism and insulin resistance — including hair loss (60.0%), acne

(30.0%), hirsutism (28.6%), and acanthosis nigricans (37.1%) — occurred at rates comparable to those described in national and international literature.^[10,14] Metabolic and psychological comorbidities added to the overall burden. Diabetes mellitus (11.4%) and hypertension (12.9%) were present at rates higher than the general female population of similar age in India but consistent with the known increased cardiometabolic risk in PCOS.^[9,14] Sleep apnoea was reported by 4.3% of participants; while lower than some Western clinic series, this may reflect under-diagnosis in rural settings. The 40.0% prevalence of psychological symptoms (stress, anxiety, or depression) is particularly concerning and strongly aligns with the meta-analysis by Barry et al., which demonstrated significantly elevated rates of anxiety and depression in women with PCOS compared with controls.^[11]

Our analysis of socio-demographic associations revealed several clinically relevant patterns. Older age was significantly associated with diabetes, sleep apnoea, psychological symptoms, and history of oral contraceptive use, suggesting that metabolic and psychological complications accumulate with age in this population — a finding consistent with the progressive nature of insulin resistance and its sequelae described in the literature.^[6,9] Irregular menstrual cycles were significantly more common among rural women, while sedentary lifestyle was more prevalent in urban participants. These urban–rural differences in lifestyle and symptom reporting have received limited attention in previous Indian studies and warrant further investigation.^[14] Infertility and oral contraceptive use were reported more frequently by housewives; these associations most likely reflect confounding by older age and higher likelihood of marriage rather than a direct occupational effect, a pattern also noted in other clinic-based studies.^[13,14]

Notably, we found no statistically significant associations between BMI category or physical activity level and major complications such as diabetes, hypertension, or infertility. While the direction of associations was clinically expected (higher rates of metabolic complications among obese participants), the lack of statistical significance is most likely attributable to the modest sample size, which limited statistical power — a limitation shared by many small hospital-based PCOS studies in India.^[12,13] Larger, adequately powered investigations are needed to clarify these relationships.

Strengths and limitations

The principal strength of this study lies in its focus on rural, low-income women attending public tertiary care — a group that has received limited attention in previous Indian PCOS research.^[12–14] We used standardised measurement protocols and collected a broad range of clinical, reproductive, and lifestyle variables. Limitations include the relatively small sample size, the hospital-based setting (which may

have selected for more symptomatic women), the cross-sectional design (precluding causal inference), and reliance on self-reported data for some variables. We also did not perform biochemical testing or ultrasound for all participants.

CONCLUSION

Women with PCOS attending public tertiary care in Andhra Pradesh carry a high burden of modifiable risk factors, central obesity, reproductive difficulties, metabolic problems, and psychological distress. Our findings support the urgent need for integrated, low-cost interventions focusing on lifestyle modification, mental health support, and early screening for metabolic complications, particularly in resource-limited public health settings. Larger community-based and longitudinal studies are required to guide more effective, context-specific prevention strategies.

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

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