Original Article

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Prevalence of Thyroid Disorders in Women with Polycystic Ovarian Syndrome: A Cross-sectional Study from Bengaluru, Karnataka, India

Obstetrics and Gynaecology Section

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ABSTRACT

Introduction: Polycystic Ovarian Syndrome (PCOS) is a prevalent endocrine disorder in reproductive-age women, often associated with metabolic and psychological complications. Emerging evidence suggests a link between PCOS and thyroid dysfunction, particularly hypothyroidism, yet data on their co-existence remains limited, especially in Indian settings. Existing studies lack uniformity and sufficient sample sizes. The present study addresses these gaps by assessing the prevalence of thyroid disorders in women with PCOS.

Aim: To determine the prevalence of thyroid disorders in women with PCOS in a tertiary care setting in Bengaluru, Karnataka, India.

Materials and Methods: The present cross-sectional study was conducted over a period of six months from July 2024 to December 2024 at ESIC Medical College and PGIMSR, Rajajinagar, Bengaluru, Karnataka, India involving 70 women aged 18-40 years diagnosed with PCOS based on the Revised 2003 Rotterdam criteria. Women who were pregnant, had postpartum status within six months, had prior thyroid surgery, or refused to participate were excluded from the study. Participants underwent detailed clinical evaluation and relevant biochemical investigations, including thyroid function tests {serum Thyroid-Stimulating Hormone (TSH), free Triiodothyronine (T3), and free Thyroxine (T4)} and anti-Thyroid Peroxidase (anti-TPO) antibody assessment. Abdominal and pelvic ultrasonography was performed to confirm polycystic ovarian morphology. Data were compiled and analysed using Statistical Package for the Social Sciences (SPSS) software version 22. Continuous variables were expressed as mean±standard deviation, while categorical variables were presented as frequencies and percentages.

Results: In the present cross-sectional study of 70 women with PCOS, the mean age was 27.83±5.50 years. Among the participants, 37 women (52.9%) were married, and 26 women (37.1%) reported irregular menstrual cycles. Of the 37 married women, 18 (48.6%) had fertility issues. Hypothyroidism was observed in 32 women (45.7%), hyperthyroidism in eight women (11.4%), and overall abnormal thyroid function was detected in 41 women (58.6%). Obesity, defined as Body Mass Index (BMI) >30 kg/m^2, was present in 46 women (65.7%), while clinical hyperandrogenism was noted in 15 women (21.4%). Elevated HbA1c levels (>6%) were found in 49 women (70%), and raised triglyceride levels (>150 mg/dL) were observed in 23 women (32.9%). Anti-TPO antibody positivity was detected in one woman (1.4%).

Conclusion: The present study demonstrated a high prevalence (58.6%) of thyroid dysfunction, particularly hypothyroidism, among women with PCOS, along with frequent menstrual irregularities, obesity, and metabolic abnormalities, supporting the need for routine thyroid screening in women with PCOS.

Keywords: Hypothyroidism, Insulin resistance, Menstrual disorders, Reproductive endocrinology, Thyroid dysfunction

INTRODUCTION

The PCOS is a complex endocrine disorder commonly observed in women of reproductive age [1]. It is characterised by chronic anovulation, hyperandrogenism, and polycystic ovarian morphology [2]. In addition to its reproductive manifestations, PCOS is associated with significant metabolic derangements such as insulin resistance, dyslipidemia, and obesity [3]. Psychological morbidity, including depression and anxiety, further complicates its burden. In recent years, there has been growing recognition of the overlap between PCOS and thyroid dysfunction, both of which can independently contribute to menstrual irregularities, infertility, and metabolic disturbances [4].

PCOS affects approximately 4% to 20% of women of reproductive age globally, depending on the diagnostic criteria applied [5]. Thyroid disorders, particularly hypothyroidism, are also prevalent among women in this age group [6]. Studies have reported a higher incidence of thyroid dysfunction, including autoimmune thyroiditis, among women with PCOS, suggesting a possible bi-directional relationship [7-10]. However, the exact prevalence and pattern of thyroid disorders among PCOS patients remain underexplored in many populations, especially within Indian tertiary care settings.

Although individual associations between PCOS and thyroid disorders have been reported, limited literature has systematically examined this coexistence in a population-specific manner [11-13]. Existing studies show considerable heterogeneity in study design, sample size, and diagnostic criteria used for both PCOS and thyroid dysfunction [14,15]. Moreover, there is insufficient data from cross-sectional analyses within Indian cohorts, thereby limiting generalisability and clinical applicability. The present study addresses a critical gap by evaluating the prevalence of thyroid disorders in women with PCOS, facilitating early identification and integrated management strategies.

MATERIALS AND METHODS

The present study was a hospital-based cross-sectional observational study conducted at ESIC Medical College and PGIMSR, Rajajinagar, Bengaluru, Karnataka, India over a period of six months from July 2024 to December 2024. The study was initiated after obtaining approval from the Institutional Ethics Committee (IEC) of ESIC Medical College and PGIMSR, Bengaluru (IEC approval letter number: No.532/L/11/12/Ethics/ESICMC&PGIMSR/Estt.Vol.IV/59-B/2024).

Inclusion and Exclusion criteria: Women aged 18-40 years with a confirmed diagnosis of PCOS based on the Revised 2003 Rotterdam consensus criteria were included in the study [16]. Diagnosis of PCOS required the presence of at least two of the following features: oligo or anovulation, clinical or biochemical evidence of hyperandrogenism, and polycystic ovarian morphology on ultrasonography, in accordance with the Revised 2003 Rotterdam consensus criteria [16]. Exclusion criteria included refusal to participate, pregnancy, postpartum status within the previous six months, and a history of thyroid surgery.

Sample size calculation: The sample size was calculated assuming an anticipated prevalence of 50%, which provides the maximum sample size in the absence of uniform prevalence data, with a 95% confidence level and an absolute precision of 12%. The minimum required sample size was calculated using the standard formula for estimation of a single proportion: $n=Z^2 \times p\ (1-p)/d^2$; where Z=1.96 (for 95% confidence interval), p=anticipated prevalence, and d=absolute precision. Based on this calculation, the minimum required sample size was 67. A total of 70 participants were enrolled consecutively to account for potential non-response and incomplete data. As this was a time-bound, cross-sectional study conducted over six months, all eligible patients presenting during the present study period were included.

Study Procedure

Eligible participants were evaluated using a pre-validated, structured proforma to record demographic details, menstrual history, and obstetric history. A detailed clinical examination, including general, systemic, abdominal, and pelvic examination, was performed for all participants. Biochemical investigations included thyroid function tests comprising serum TSH, free T3, and free T4 levels, along with anti-TPO antibody testing to assess autoimmune thyroid disease. All laboratory investigations were carried out in the institutional biochemistry laboratory using standard protocols. Abdominal and pelvic ultrasonography was performed to confirm polycystic ovarian morphology. The collected data were analysed to determine the prevalence of thyroid disorders among women with PCOS. Thyroid dysfunction was defined based on abnormal serum TSH levels with or without altered free T3 and free T4 values as per standard diagnostic criteria [17].

STATISTICAL ANALYSIS

Data were compiled in Microsoft Excel and analysed using SPSS software version 22. Continuous variables were expressed as mean±standard deviation, and categorical variables were presented as frequencies and percentages.

RESULTS

Among the 70 women with PCOS enrolled in the study, the highest proportion belonged to the 26-30-year age group (20 women, 28.6%), followed by the 31-35-year age group (19 women, 27.1%). Only six women (8.6%) were older than 35 years. The mean age of the participants was 27.83±5.50 years, with a median age of 28 years. With regard to marital status, 37 women (52.9%) were married and 33 women (47.1%) were unmarried [Table/Fig-1].

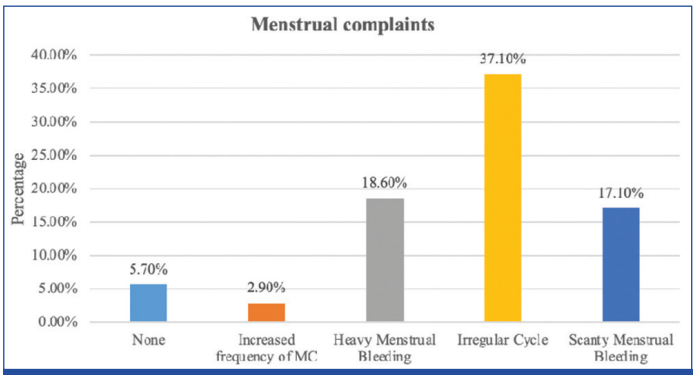
Irregular menstrual cycles were the most common complaint, reported by 26 women (37.1%), followed by heavy menstrual bleeding in 13 women (18.6%) and scanty menstrual flow in 12 women (17.1%). Only four women (5.7%) reported no menstrual complaints, while increased frequency of menstruation was observed in two women (2.9%) [Table/Fig-2].

Among the 37 married women, fertility problems were reported by 18 women (48.6%). Of these, 10 women (27.0%) were nulliparous and 27 women (73.0%) were parous [Table/Fig-3].

Among the parous women, a history of abortion was noted in five women (18.5%), and high-risk pregnancies were reported in eight women (29.6%) [Table/Fig-4].

Subjects (N=70)		Frequency (N)	Percentage (%)
Age group (years)	18 to 20	9	12.9%
	21 to 25	16	22.9%
	26 to 30	20	28.6%
	31 to 35	19	27.1%
	>35	6	8.6%
Marital Status	Unmarried	33	47.1%
	Married	37	52.9%

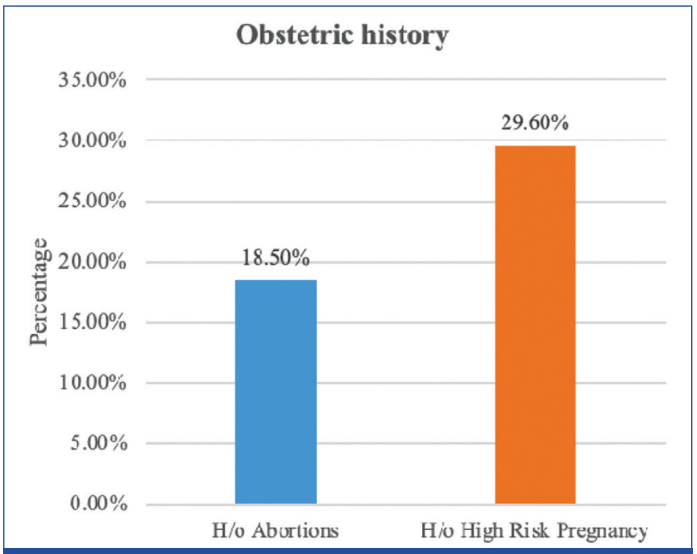
[Table/Fig-1]: Characteristics of the study subjects.



[Table/Fig-2]: Menstrual complaints among the study subjects.

Subjects (N=37)		Frequency (N)	Percentage (%)
Fertility problems	Yes	18	48.6%
	No	19	51.4%
Parity	Nulliparous	10	27.0%
	Parous	27	73.0%

[Table/Fig-3]: Reproductive history of the study subjects.



[Table/Fig-4]: Obstetric history of the study subjects.

Hypothyroidism was the most common thyroid disorder, observed in 32 women (45.7%), followed by hyperthyroidism in eight women (11.4%) and Graves' disease in one woman (1.4%). No thyroid disorder was detected in 29 women (41.4%). Other comorbid conditions such as hypertension and type 2 diabetes mellitus were present in 23 women (32.9%), while a family history of thyroid disorders was reported by 17 women (24.3%) [Table/Fig-5].

A majority of participants, 46 women (65.7%), had been diagnosed with PCOS for more than one year. With respect to treatment status, 32 women (45.7%) were not receiving any treatment, 22 women (31.4%) were on lifestyle modification, and 16 women (22.9%) were using oral contraceptive pills. Among those receiving treatment (n=38), 21 women (55.3%) had been on treatment for less than six months. Obesity, defined as body mass index greater than 30

Subjects (N=70)		Frequency (N)	Percentage (%)
Thyroid disorder	Nil	29	41.4%
	Hyperthyroidism	8	11.4%
	Grave's Disease	1	1.4%
	Hypothyroidism	32	45.7%
Other co-morbidities	Yes	23	32.9%
	No	47	67.1%
Family H/o thyroid disorder	Yes	17	24.3%
	No	53	75.7%

[Table/Fig-5]: Medical and family history.

kg/m^2, was observed in 46 women (65.7%), while only 7 women (10.0%) had a normal body mass index. Clinical hyperandrogenism was noted in 15 women (21.4%) [Table/Fig-6].

Subjects (N=70)		Frequency (N)	Percentage (%)
Duration since PCOS diagnosis	<12 months	24	34.3%
	>12 months	46	65.7%
On treatment for PCOS	Nil	32	45.7%
	Lifestyle modification	22	31.4%
	Oral contraceptives	16	22.9%
Duration of PCOS treatment	<6 months	21	55.3%
	>6 months	17	44.7%
Body mass index	18.5 to 24.9 kg/m^2	7	10.0%
	25.0 to 29.9 kg/m^2	17	24.3%
	>30.0 kg/m^2	46	65.7%
Hyperandrogenism	Yes	15	21.4%
	No	55	78.6%

[Table/Fig-6]: PCOS-related information.

Elevated glycated haemoglobin levels (>6.0%) were found in 49 women (70.0%). Total cholesterol levels were within normal limits in 60 women (85.7%), whereas elevated triglyceride levels were observed in 23 women (32.9%). Luteinising hormone levels were within the normal range in 68 women (97.1%), while elevated follicle-stimulating hormone levels were noted in 36 women (51.4%). Prolactin levels were normal in all participants (70 women, 100%), and testosterone levels were within normal limits in 68 women (97.1%) and elevated testosterone was present in 2 women (2.9%) [Table/Fig-7].

Overall, abnormal thyroid function was detected in 41 women (58.6%), while 29 women (41.4%) had normal thyroid profiles. The mean serum TSH level was 4.79±2.60 mIU/L (range: 0.01-9.00 mIU/L). Anti-TPO antibody positivity was observed in only one woman (1.4%). Thyroid ultrasonography revealed abnormalities in three women, including hypoechoic areas in two women (2.9%) and goitre in one woman (1.4%). The mean endometrial thickness was 8.09±2.75 mm [Table/Fig-8].

Subjects (N=70)		Frequency (N)	Percentage (%)
HbA1c	<6.0%	21	30.0%
	>6.0%	49	70.0%
Total cholesterol	<200 mg/dL	60	85.7%
	>200 mg/dL	10	14.3%
Triglycerides	<150 mg/dL	47	67.1%
	>150 mg/dL	23	32.9%
Luteinising hormone	5 to 25 IU/L	68	97.1%
	>25 IU/L	2	2.9%
Follicle-stimulating hormone	3 to 9 IU/L	34	48.6%
	>9 IU/L	36	51.4%
Prolactin	2 to 29 ng/mL	70	100.0%
	>29 ng/mL	0	0.0%
Testosterone	15 to 70 ng/mL	68	97.1%
	>70 ng/mL	2	2.9%

[Table/Fig-7]: Laboratory investigations.

Subjects (N=70)		Frequency (N)	Percentage (%)
Thyroid function	Normal	29	41.4%
	Abnormal	41	58.6%
Thyroid peroxidase	Negative	69	98.6%
	Positive	1	1.4%
Thyroid scan	Nil	67	95.7%
	Hypoechoic areas	2	2.9%
	Goiter	1	1.4%

[Table/Fig-8]: Thyroid profile and imaging studies.

DISCUSSION

The present study demonstrated a high prevalence of thyroid dysfunction (58.6%) among women with PCOS, with hypothyroidism being the predominant abnormality. Menstrual irregularities, obesity, metabolic disturbances, and fertility-related concerns were frequently observed, highlighting the substantial endocrine and metabolic burden associated with PCOS. The age distribution of the present study population corresponds with the established epidemiology of the condition, which predominantly affects women during their reproductive years. Menstrual disturbances, particularly oligomenorrhoea and cycle irregularities, reflected underlying ovulatory dysfunction, while nearly half of the married participants reported fertility problems, emphasising the persistent reproductive challenges despite prior conception in some women.

The occurrence of obstetric complications among parous women further underscores the adverse reproductive impact of PCOS, likely mediated by insulin resistance, obesity, and hormonal imbalance. The predominance of hypothyroidism suggests a meaningful overlap between thyroid dysfunction and PCOS; however, the low prevalence of autoimmune thyroid disease indicates that functional, non-autoimmune hormonal dysregulation may play a larger role in this population. Obesity emerged as a central feature exacerbating metabolic and endocrine abnormalities, while the relatively low prevalence of hyperandrogenemia despite significant metabolic derangements points toward phenotypic variability, with insulin resistance and altered gonadotropin secretion being more prominent than androgen excess. Collectively, these findings reinforce the multifaceted nature of PCOS and support the need for comprehensive endocrine evaluation, including routine thyroid assessment, in affected women.

In the present study, the mean age of participants was 27.83±5.50 years, which closely aligns with Janssen OE et al., (28.4±6.5 years) and van der Ham K et al., (median 28.5 years, IQR 24–33) [11,12]. Kachuei M et al., and Sinha U et al., reported younger cohorts, with mean ages of 23.95±5.2 years and 22.7±5.3 years, respectively [13,14]. These variations reflect geographical and demographic differences in PCOS expression.

The present study documented irregular menstrual cycles in 37.1% of subjects, while other abnormalities such as heavy menstrual bleeding (18.6%) and scanty bleeding (17.1%) were also noted, reflecting a diverse clinical presentation. Shanmugham D et al., reported a higher frequency of oligomenorrhoea (54.3%) and amenorrhoea (21.7%), along with metrorrhagia in 24% of patients [15]. Sinha U et al., found 77.5% of their subjects had oligomenorrhoea and 15% had amenorrhoea, supporting the predominance of ovulatory dysfunction in PCOS [14]. The present study, by distinguishing between varied menstrual complaints rather than limiting to oligomenorrhoea or amenorrhoea, provides a broader clinical understanding. The inclusion of atypical symptoms such as heavy and scanty bleeding, absent in previous studies, highlights the heterogeneous menstrual profiles in PCOS.

In the present study, infertility was documented in 48.6% of married women, with 27% of the total cohort being nulliparous. These findings suggest substantial reproductive morbidity among PCOS patients. Shanmugham D et al., reported 22% of their participants as nulliparous but did not assess infertility specifically [15]. van der Ham K et al., reported infertility in 45.8% of their PCOS group, closely mirroring the present study [12]. The reproductive morbidity due to PCOS has long been associated with ovulatory dysfunction, insulin resistance, and hormonal imbalance. The present study thus contributes valuable reproductive epidemiology by quantifying nulliparity and infertility in PCOS, a domain underreported in prior research. These findings collectively suggest that nearly half of PCOS patients experience infertility, confirming the critical need for early diagnosis and fertility-focused interventions as part of PCOS management in clinical practice.

In the present study, hyperandrogenism was documented in 21.4% of participants, significantly lower than previous studies Janssen OE et al., (91%), van der Ham K et al., (79.9%), Sinha U et al., (72.5%), and Shanmugham D et al., (52%) [11,12,14,15]. Kachuei M et al., included hyperandrogenism as a selection criterion [13]. Obesity (BMI >30 kg/m^2) was present in 65.7% of the present study cohort, similar to Janssen OE et al., (mean BMI 30.0±7.9) but higher than Shanmugham D et al., (32%) [11,15] and van der Ham K et al., (median BMI: 27.0) [12]. These data suggest that the present study population displayed a metabolically heavier but clinically milder androgenic phenotype of PCOS. Although all studies used Rotterdam criteria for diagnosis, differences in sample characteristics and diagnostic emphasis (clinical vs biochemical hyperandrogenism) could explain this disparity. The low hyperandrogenism rate in the present study, despite a high BMI, might reflect a unique phenotype more prone to metabolic and thyroid dysfunction than androgen excess. Thus, the present study supports the growing recognition of phenotypic variability in PCOS, with some populations particularly obese, non-hyperandrogenic women being more susceptible to thyroid disorders than traditional hyperandrogenic presentations.

In the present study, thyroid dysfunction was observed in 60% of women with PCOS, with hypothyroidism documented in 45.7%, hyperthyroidism in 11.4%, and subclinical cases likely accounting for the remainder. Despite this high prevalence, only 1.4% tested positive for anti-TPO antibodies, and imaging abnormalities such as hypoechogenicity and goitre were rare (2.9% and 1.4%, respectively). Mean TSH was elevated at 4.79±2.6 mIU/L. In contrast, previous studies reported lower overall thyroid dysfunction but higher autoimmune involvement. Janssen OE et al., found TPO positivity in 26.9%, hypoechoic thyroid in 42.3%, and mean TSH of 2.0±1.0 mIU/L [11]. Kachuei M et al., reported 30.6% TPO positivity, 62.3% with goitre or hypoechogenicity, and a lower mean TSH of 2.77±3.8 [13]. Sinha U et al., identified 27.5% with thyroid dysfunction (22.5% subclinical), TPO positivity in 22.5%, and mean TSH similar to the present study (4.55±2.66) [14]. van der Ham K et al., observed 23.7% hypothyroidism and 15.6% TPO positivity with a median TSH of 1.8 mIU/L [12]. Across all previous studies, autoimmune thyroiditis was a dominant finding, in contrast to the non-autoimmune pattern suggested in the present study [11-14]. This distinction indicates a potential phenotypic variation in thyroid dysfunction among PCOS patients, possibly influenced by metabolic or genetic factors specific to the population studied.

Limitation(s)

The cross-sectional design of the present study limits causal interpretation between PCOS and thyroid dysfunction. The single-center setting may restrict the generalisability of the findings. Additionally, the absence of longitudinal follow-up precluded assessment of temporal changes in thyroid status. Despite these limitations, the study provides useful insight into the prevalence of thyroid disorders among women with PCOS.

CONCLUSION(S)

The present study highlights a high prevalence (58.6%) of thyroid dysfunction, particularly hypothyroidism (45.7%), among women with PCOS, justifying the objective of assessing thyroid disorders in this population. Menstrual irregularities, obesity, and metabolic disturbances such as elevated HbA1c and triglycerides were commonly observed, alongside a notable proportion with fertility issues. Despite abnormal thyroid function, anti-TPO positivity and imaging findings were infrequent. These findings support the need for routine thyroid evaluation in women with PCOS to ensure timely diagnosis and management, given the significant overlap between endocrine dysfunction and reproductive or metabolic complications in this group.

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