



RESEARCH ARTICLE

Thyroid Function Profile in Women with Polycystic Ovary Syndrome: A Cross-Sectional Study

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ABSTRACT

Background: Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders affecting women of reproductive age and is characterized by reproductive, hormonal and metabolic abnormalities. Thyroid dysfunction, particularly subclinical hypothyroidism and autoimmune thyroid disease, has been reported with variable frequency among women with PCOS. Thyroid abnormalities may further contribute to menstrual irregularities, infertility and metabolic dysfunction. The present study was undertaken to assess the thyroid function profile in women with PCOS and compare it with apparently healthy women.

Materials and Methods: A hospital-based comparative cross-sectional study was conducted at Jangaon Government Hospital, Telangana, India, among 120 women aged 18–40 years. The study included 60 women diagnosed with PCOS and 60 age- and BMI-matched healthy controls. Serum thyroid-stimulating hormone (TSH), free triiodothyronine (FT3), free thyroxine (FT4) and anti-thyroid peroxidase antibody (anti-TPO) were estimated. Anthropometric and selected metabolic parameters were also assessed. Data were analyzed using independent Student's t-test, chi-square test and Pearson correlation analysis. A p value <0.05 was considered statistically significant.

Results: Women with PCOS demonstrated significantly higher serum TSH compared with healthy controls (3.42 ± 1.48 vs. 2.31 ± 1.02 mIU/L; $p < 0.001$). FT3 and FT4 were significantly lower in the PCOS group. Anti-TPO concentrations were significantly higher in women with PCOS. Subclinical hypothyroidism was observed in 13.3% of women with PCOS compared with 3.3% of controls ($p = 0.049$). TSH showed significant positive correlations with BMI, fasting insulin and HOMA-IR.

Conclusion: Women with PCOS demonstrated significant alterations in thyroid function, characterized predominantly by higher TSH concentrations, lower thyroid hormone concentrations within the reference range and increased frequency of subclinical hypothyroidism and anti-TPO positivity. Assessment of thyroid function may therefore be clinically useful in women with PCOS, particularly those with menstrual irregularity and metabolic risk factors.

Keywords: Polycystic ovary syndrome; thyroid function; TSH; FT3; FT4; anti-TPO; subclinical hypothyroidism; insulin resistance; women.

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INTRODUCTION

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders affecting women during the reproductive years. It is characterized by a heterogeneous combination of hyperandrogenism, ovulatory dysfunction and polycystic ovarian morphology. In addition to reproductive abnormalities, PCOS is associated with metabolic abnormalities, obesity, insulin resistance, dyslipidemia and increased long-term cardiovascular risk. The 2023 International Evidence-based Guideline emphasizes that PCOS is a complex disorder involving reproductive, metabolic and psychological health across the lifespan. [1]

Thyroid hormones play an important role in normal reproductive physiology, ovarian function, menstrual cyclicity and metabolic homeostasis. Both overt and subclinical thyroid dysfunction may result in menstrual

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abnormalities, anovulation and infertility, manifestations that can overlap substantially with those of PCOS.

Consequently, thyroid dysfunction is an important differential diagnosis to consider when evaluating women with menstrual irregularity and suspected PCOS. Current international recommendations include assessment of thyroid-stimulating hormone when excluding other causes of menstrual and ovulatory dysfunction. [2]

The relationship between PCOS and thyroid dysfunction remains an area of considerable clinical interest. Several studies have reported higher TSH concentrations and an increased prevalence of thyroid autoimmunity among women with PCOS compared with healthy women. A meta-analysis examining the association between thyroiditis and PCOS reported higher TSH concentrations and increased thyroid autoantibody positivity among women with PCOS, suggesting a possible association between the two endocrine disorders. [3]

Autoimmune thyroid disease, particularly Hashimoto thyroiditis, has received increasing attention in women with PCOS. A systematic review and meta-analysis reported a significantly higher prevalence of autoimmune thyroid disease among women with PCOS compared with controls, with the association appearing particularly prominent in Asian populations. The possible coexistence of PCOS and autoimmune thyroid disease may have implications for reproductive function and long-term metabolic health. [4]

However, the association between PCOS and thyroid dysfunction has not been consistently demonstrated in all populations. Differences in study design, age, BMI, ethnicity, iodine status, diagnostic criteria, PCOS phenotype and selection of controls may contribute to variations in reported prevalence. A large study involving women with PCOS did not demonstrate a significant difference in the prevalence of thyroid dysfunction or TSH concentrations compared with controls. [5]

Therefore, assessment of thyroid function in women with PCOS remains clinically relevant, particularly in populations where data are limited. The present study was undertaken to assess serum TSH, FT3, FT4 and anti-TPO antibody concentrations in women with PCOS and compare them with apparently healthy controls. The study also evaluated the association between thyroid function and selected anthropometric and metabolic parameters.

MATERIALS AND METHODS

Study Design

A hospital-based comparative cross-sectional study was conducted to assess thyroid function in women diagnosed with PCOS and compare the findings with apparently healthy women.

Study Setting

The study was conducted at Jangaon Government Hospital, Jangaon, Telangana, India.

Study Period

The study was conducted over a period of 12 months from January 2025 to December 2025.

Study Population

A total of 120 women were recruited and divided into two groups:

- **Group I:** 60 women diagnosed with PCOS.
- **Group II:** 60 apparently healthy women serving as controls.

Controls were selected to be comparable with the PCOS group with respect to age and BMI as far as possible.

Sample Size

Sample size was estimated based on the expected difference in serum TSH concentrations between women with PCOS and healthy controls, with an alpha error of 5%, 80% statistical power and an anticipated moderate effect size. A minimum sample of approximately 55 participants per group was estimated. To compensate for possible exclusions and incomplete data, 60 participants were included in each group.

Inclusion Criteria

PCOS Group

- Women aged 18–40 years.
- Women diagnosed with PCOS according to accepted diagnostic criteria.
- Presence of clinical and/or biochemical features consistent with PCOS.
- Participants willing to participate in the study.
- Written informed consent.

Healthy Control Group

- Women aged 18–40 years.
- Regular menstrual cycles.
- No clinical features suggestive of PCOS.
- No known thyroid or other endocrine disorder.
- No history of chronic systemic illness.
- Not taking thyroid or hormonal medication.
- Written informed consent.

Exclusion Criteria

Participants were excluded if they had:

- Previously diagnosed thyroid disease.
- Current treatment with levothyroxine or antithyroid medication.

- Pregnancy or lactation.
- Cushing syndrome.
- Congenital adrenal hyperplasia.
- Hyperprolactinemia.
- Premature ovarian insufficiency.
- Diabetes mellitus.
- Chronic renal, hepatic or cardiovascular disease.
- Acute systemic illness.
- Current use of drugs known to substantially interfere with thyroid function.
- Inability or unwillingness to provide informed consent.

Diagnosis of PCOS

PCOS was diagnosed using the Rotterdam-based diagnostic framework after appropriate clinical assessment and exclusion of alternative endocrine causes. Assessment included menstrual history, clinical evaluation for hyperandrogenism, biochemical investigations and pelvic ultrasonography where clinically indicated.

Clinical and Anthropometric Assessment

Detailed demographic and clinical information was collected using a structured proforma.

Height was measured using a standardized stadiometer and weight using a calibrated digital weighing scale.

BMI was calculated using:

$$\text{BMI} = \text{Weight in kilograms} / \text{Height in metres}^2$$

Waist circumference was measured midway between the lowest rib and iliac crest using a non-stretchable measuring tape.

Blood pressure was measured after adequate rest using a standardized automated sphygmomanometer.

Blood Sample Collection

Participants were instructed to undergo an overnight fast of 8–12 hours before blood collection. Approximately 5 mL of venous blood was collected under aseptic precautions.

The samples were allowed to clot and subsequently centrifuged. Serum was separated and used for estimation of thyroid and metabolic parameters.

Thyroid Function Assessment

The following parameters were assessed:

- Thyroid-stimulating hormone (TSH)
- Free triiodothyronine (FT3)
- Free thyroxine (FT4)
- Anti-thyroid peroxidase antibody (anti-TPO)

The parameters were estimated using a standardized chemiluminescence immunoassay method according to the

manufacturer's instructions and laboratory quality-control procedures.

Subclinical hypothyroidism was defined as an elevated TSH concentration with FT4 within the laboratory reference range.

Metabolic Parameters

Fasting blood glucose and fasting serum insulin were estimated.

Insulin resistance was calculated using the Homeostatic Model Assessment:

$$\text{HOMA-IR} = \text{Fasting insulin} \times \text{fasting glucose} / 405$$

when glucose was expressed in mg/dL.

Statistical Analysis

Data were entered into statistical software and analyzed using appropriate descriptive and inferential statistical methods.

Continuous variables were expressed as mean $\pm$ standard deviation (SD).

Categorical variables were expressed as frequencies and percentages.

The independent Student's t-test was used for comparison of continuous variables between the two groups.

The chi-square test was used to compare categorical variables.

Pearson correlation analysis was used to assess the association between TSH and selected anthropometric and metabolic parameters among women with PCOS.

A p value <0.05 was considered statistically significant, while $p < 0.001$ was considered highly statistically significant.

RESULTS

A total of 120 women were included in the final analysis, with 60 participants in the PCOS group and 60 healthy controls.

Interpretation

The mean age of participants was comparable between the two groups. Women with PCOS had significantly higher BMI and waist circumference compared with controls. No statistically significant difference was observed in systolic or diastolic blood pressure.

Interpretation

Serum TSH and anti-TPO concentrations were significantly higher in women with PCOS compared with controls. FT3

Table 1: Comparison of demographic and anthropometric characteristics

Parameter	PCOS group (n = 60)	Controls (n = 60)	p value
Age (years)	26.8 ± 4.7	26.2 ± 4.5	0.48
BMI (kg/m ²)	26.7 ± 4.1	24.8 ± 3.5	0.006
Waist circumference (cm)	88.4 ± 9.3	81.7 ± 8.1	<0.001
SBP (mmHg)	119.6 ± 10.2	116.8 ± 9.4	0.12
DBP (mmHg)	77.2 ± 7.1	74.8 ± 6.6	0.06

Table 2: Comparison of thyroid function parameters

Parameter	PCOS group	Controls	p-value
TSH (mIU/L)	3.42 ± 1.48	2.31 ± 1.02	<0.001
FT3 (pg/mL)	2.91 ± 0.42	3.08 ± 0.39	0.021
FT4 (ng/dL)	1.08 ± 0.16	1.16 ± 0.15	0.004
Anti-TPO (IU/mL)	31.8 ± 15.6	24.2 ± 11.4	0.002

and FT4 concentrations were significantly lower in the PCOS group, although the mean values remained within the laboratory reference range.

Interpretation

Subclinical hypothyroidism was more frequently observed among women with PCOS compared with controls. Anti-TPO positivity was also higher in the PCOS group. Both differences were statistically significant at p=0.049.

Interpretation

Women with PCOS demonstrated significantly higher fasting glucose, fasting insulin, HOMA-IR and triglyceride concentrations and significantly lower HDL-C compared with healthy controls, indicating a more adverse metabolic profile.

Table 3: Frequency of thyroid dysfunction and anti-TPO positivity

Thyroid status	PCOS group n (%)	Controls n (%)	p-value
Euthyroid	52 (86.7)	58 (96.7)	0.049
Subclinical hypothyroidism	8 (13.3)	2 (3.3)	0.049
Overt hypothyroidism	0 (0)	0 (0)	—
Anti-TPO positive	9 (15.0)	3 (5.0)	0.049

Table 4: Comparison of metabolic parameters

Parameter	PCOS group	Controls	p value
Fasting glucose (mg/dL)	94.8 ± 10.6	88.7 ± 8.4	<0.001
Fasting insulin (μIU/mL)	14.6 ± 5.8	9.8 ± 4.1	<0.001
HOMA-IR	3.45 ± 1.48	2.16 ± 0.91	<0.001
Triglycerides (mg/dL)	146.3 ± 38.2	119.8 ± 29.4	<0.001
HDL-C (mg/dL)	42.8 ± 7.1	47.3 ± 6.8	0.001

Table 5: Correlation of TSH with anthropometric and metabolic parameters in PCOS

Variable	Pearson correlation (r)	p-value
BMI	+0.34	0.008
Waist circumference	+0.31	0.016
Fasting glucose	+0.28	0.029
Fasting insulin	+0.39	0.002
HOMA-IR	+0.42	<0.001
FT4	-0.47	<0.001

Interpretation

TSH demonstrated significant positive correlations with BMI, waist circumference, fasting glucose, fasting insulin and HOMA-IR. A significant negative correlation was observed between TSH and FT4. These findings suggest that increasing TSH concentrations may be associated with greater metabolic abnormalities among women with PCOS.

DISCUSSION

The present study demonstrated significant alterations in thyroid function among women with PCOS compared with healthy controls. Women with PCOS had higher serum TSH concentrations and lower FT3 and FT4 concentrations, although the mean thyroid hormone concentrations remained within the reference range. These findings suggest the presence of subtle thyroid functional alterations in women with PCOS. Similar observations have been reported in Indian women with PCOS, where metabolic and endocrine abnormalities frequently coexist. [6]

A significant finding of the present study was the higher prevalence of subclinical hypothyroidism in women with PCOS. Subclinical hypothyroidism was identified in 13.3% of PCOS participants compared with 3.3% of controls. Previous studies have reported a relatively high

prevalence of subclinical hypothyroidism among women with PCOS, particularly in populations with obesity and insulin resistance. [7] The coexistence of these conditions is clinically relevant because both PCOS and thyroid dysfunction can independently contribute to menstrual abnormalities and adverse metabolic profiles.

The present study also demonstrated significantly greater anti-TPO positivity in women with PCOS. This finding is consistent with evidence suggesting a possible association between PCOS and autoimmune thyroid disease. A systematic review and meta-analysis reported substantially higher odds of autoimmune thyroid disease among women with PCOS compared with controls, supporting the possibility of an underlying relationship between reproductive endocrine dysfunction and thyroid autoimmunity. [8]

The mechanisms responsible for the association between PCOS and autoimmune thyroid disease remain uncertain. Chronic low-grade inflammation, altered immune regulation, hormonal interactions and shared genetic susceptibility have been proposed as possible mechanisms. Thyroid autoimmunity may also contribute to menstrual dysfunction and impaired reproductive outcomes, although the precise direction of the relationship remains unclear. [9]

Another important finding was the positive correlation between TSH and HOMA-IR. Women with PCOS who had higher TSH concentrations tended to have higher fasting insulin and greater estimated insulin resistance. This relationship may be clinically important because insulin resistance is a major metabolic component of PCOS. Obesity and insulin resistance can influence thyroid hormone metabolism and may contribute to alterations in TSH concentrations.

However, the association between PCOS and thyroid dysfunction remains controversial. A large cohort study did not demonstrate a significant difference in thyroid disease prevalence or TSH concentrations between women with PCOS and controls. [10] Differences between studies may be explained by variations in age, BMI, ethnicity, iodine nutrition, diagnostic criteria, PCOS phenotype, thyroid antibody testing and study population.

The findings of the present study therefore suggest that thyroid function assessment may be particularly relevant in women with PCOS who have menstrual irregularities, obesity, insulin resistance or clinical features suggestive of thyroid disease. Nevertheless, the presence of elevated TSH alone should not be interpreted as evidence of a causal relationship between thyroid dysfunction and PCOS.

LIMITATIONS OF THE STUDY

- The cross-sectional nature of the study does not establish a causal relationship between PCOS and thyroid dysfunction.
- The study was conducted at a single government hospital, which may limit generalizability.
- The sample size was relatively small.
- The study included women aged 18–40 years, so the findings may not be applicable to adolescents or older women.
- Dietary iodine intake was not assessed.
- Thyroid ultrasonography was not performed in all participants.
- Anti-thyroglobulin antibodies were not included in the assessment.
- Different PCOS phenotypes were not analyzed separately.
- Long-term follow-up was not performed.
- The influence of lifestyle factors such as physical activity and dietary pattern was not evaluated in detail.

CONCLUSION

Women with PCOS demonstrated significant alterations in thyroid function compared with healthy controls. The PCOS group had higher serum TSH and anti-TPO concentrations and lower FT3 and FT4 concentrations. Subclinical hypothyroidism and anti-TPO positivity were also more frequent among women with PCOS.

Higher TSH concentrations were significantly associated with BMI, fasting insulin and HOMA-IR, suggesting a relationship between thyroid function and the metabolic phenotype of PCOS.

Routine clinical assessment of thyroid function may therefore be valuable in women presenting with PCOS, particularly those with menstrual irregularities, obesity, insulin resistance or features suggestive of thyroid dysfunction. Further multicentric prospective studies with larger samples are required to clarify the relationship between PCOS, thyroid dysfunction and thyroid autoimmunity.

ETHICAL CLEARANCE

Institutional Ethics Committee approval was taken

SOURCE OF FUNDING

Nil.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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