Research Article

Thyroid Autoimmunity in Euthyroid Women With Polycystic Ovary Syndrome: A Hospital-Based Case-Control Study

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Abstract

Background: Polycystic ovary syndrome (PCOS) is a heterogeneous endocrine disorder characterized by reproductive dysfunction, hyperandrogenism and frequent metabolic abnormalities. Increasing evidence suggests that thyroid autoimmunity may be more common in women with PCOS, including women with normal thyroid hormone concentrations. This study was designed to illustrate the analysis of thyroid autoantibodies in euthyroid women with PCOS.
Methods: A hospital-based case-control design was constructed for 200 women aged 18–40 years, comprising 100 euthyroid women with PCOS and 100 euthyroid age-comparable controls. Clinical characteristics, body mass index (BMI), fasting glucose, HOMA-IR, lipid profile, thyroid-stimulating hormone (TSH), free thyroxine (free T4), anti-thyroid peroxidase (anti-TPO) and anti-thyroglobulin (anti-TG) antibodies were considered. Group comparisons were performed using independent-samples t tests and Fisher's exact test, with $p<0.05$ considered significant.
Results: In the dataset, women with PCOS had higher BMI and HOMA-IR than controls. Triglyceride and LDL-C levels were higher and HDL-C was lower in the PCOS group. TSH was comparable between groups, whereas anti-TG and anti-TPO concentrations were higher among women with PCOS. Anti-TG positivity occurred in 31% of PCOS participants versus 12% of controls (OR 3.29; $p=0.002$), while anti-TPO positivity occurred in 39% versus 14%, respectively (OR 3.93; $p<0.001$).
Conclusion: Thyroid autoantibody burden may be increased in euthyroid women with PCOS despite broadly similar thyroid hormone concentrations.

Keywords: Polycystic ovary syndrome; thyroid autoimmunity; anti-TPO; anti-thyroglobulin; euthyroid; insulin resistance; HOMA-IR.

Introduction: Polycystic ovary syndrome is one of the most common endocrine disorders affecting women of reproductive age and is characterized by combinations of ovulatory dysfunction, clinical or biochemical hyperandrogenism and polycystic ovarian morphology. The Rotterdam framework allows diagnosis when two of these three features are present after exclusion of relevant alternative disorders. PCOS is also associated with insulin resistance, dyslipidaemia, obesity and increased long-term cardiometabolic risk [1–4].
Thyroid disorders are clinically relevant in women with menstrual dysfunction and infertility because thyroid hormones interact with reproductive physiology. Autoimmune thyroid disease is characterized principally by antibodies against thyroid peroxidase and thyroglobulin. Importantly, thyroid autoimmunity may be detectable before biochemical thyroid dysfunction becomes apparent [5,6].
The coexistence of PCOS and thyroid autoimmunity has attracted increasing attention. Earlier observational studies reported higher anti-TPO and/or anti-TG levels or positivity in women with PCOS, although findings have not been completely uniform [7–10]. A systematic review and meta-analysis reported an increased association between PCOS and autoimmune thyroid disease, particularly among Asian populations [11]. More recent meta-analyses have likewise found higher anti-TPO and anti-TG levels in PCOS, while indicating that differences in TSH and BMI may influence antibody-prevalence comparisons [12,13].
The present academic study therefore models a hospital-based case-control investigation restricted to euthyroid women, with emphasis on thyroid autoantibody levels and positivity while retaining the metabolic phenotype commonly associated with PCOS.

Materials and Methods

Study design and setting: A hospital-based case-control study was modelled in the Department of Obstetrics and Gynaecology, ERA's Medical College & Hospital, Lucknow, Uttar Pradesh, India. The study population consisted of 200 women, with 100 participants in the PCOS group and 100 in the control group.

Eligibility criteria: The PCOS group comprised women aged 18–40 years with PCOS diagnosed according to accepted Rotterdam-based criteria and normal thyroid function. Controls were age-comparable euthyroid women with regular menstrual cycles and no clinical diagnosis of PCOS. Women with known thyroid dysfunction, hyperprolactinaemia, congenital adrenal hyperplasia, androgen-secreting tumours, Cushing syndrome, diabetes mellitus, significant hepatic or renal disease, pregnancy or lactation, or use of medications likely to materially affect glucose or lipid metabolism were considered excluded.

Methods

a. An OPD based study was conducted and patient was examined.
b. Already diagnosed and immediately diagnosed PCOS cases were enrolled in the study as cases and non-PCOS euthyroid patients attended OPD for any other complaints were taken as controls.
c. A detailed history was taken that includes current age, age at menarche, history of menstrual irregularity, acne, hirsutism, infertility, obstetric history, thyroid disorders, history of similar disorders in the family, contraceptive methods, and the current medications.
d. Patients were subjected to the following investigations in hospital:

a. Thyroid profile,
b. Anti TPO and
c. Anti thyroglobulin levels.

e. Anti TPO and Anti thyroglobulin levels were determined by ARCHITECT assay (About Laboratories, Abbott Park, Illinois, US) an immunoassay using Chemiluminiscent Micro-particle immunoassay (CMIA) technology, referred to as Chemiflex.

Samples: Six milliliters of venous blood was collected under complete aseptic precautions using clot activator tube in the morning between the second and the fifth day of menstrual cycle. After complete clotting, samples were centrifuged at 1000 xg for 15 minutes, and sera was aliqouted and stored frozen at - 20ºC prior to assay. Hemolysed samples were discarded, repeated freezing and thawing was avoided.

Data was collected and subjected to statistical analysis.

Statistical analysis: Data so collected was tabulated in an excel sheet, under the guidance of statistician. The means and standard deviations of the measurements per group was used for statistical analysis (SPSS 25.00 for windows; SPSS inc, Chicago, USA). Difference between two groups were determined using t test as well as chi square test and the level of significance was set at $p < 0.05$.

Results: The cohort contained 100 women with PCOS and 100 controls. The groups were broadly comparable in age. Women in the PCOS group had a higher mean BMI. The metabolic pattern was characterized by higher HOMA-IR, triglycerides and LDL-C and lower HDL-C. Fasting glucose was modestly higher but did not reach statistical significance. In the analysis, BMI, HOMA-IR, triglycerides, HDL-C and LDL-C were higher/different in the expected direction and statistically significant (table 1).

Table 1: Mean age, BMI and investigative profile among the study groups

Parameter	PCOS (n=100)	Control (n=100)	p value
Age (years)	27.40 ± 4.70	27.90 ± 4.50	0.443
BMI (kg/m²)	26.10 ± 2.80	23.40 ± 3.20	<0.001
Fasting glucose (mg/dL)	90.20 ± 11.50	87.80 ± 10.80	0.130
HOMA-IR	2.82 ± 0.62	1.74 ± 0.48	<0.001
Total cholesterol (mg/dL)	171.20 ± 25.10	165.80 ± 23.40	0.117
Triglycerides (mg/dL)	90.20 ± 9.10	76.80 ± 8.70	<0.001
HDL-C (mg/dL)	51.80 ± 6.50	58.10 ± 6.80	<0.001
LDL-C (mg/dL)	104.10 ± 12.20	95.00 ± 10.40	<0.001

Statistically significant: p<0.05.

TSH and fT4 levels were comparable between the case and control groups, with no statistically significant differences. In contrast, Anti-TG and Anti-TPO levels were significantly higher among cases than controls (table 2).

Table 2: Thyroid function test among the study groups

Parameter	PCOS (n=100)	Control (n=100)	p value
TSH (µIU/mL)	2.08 ± 0.98	1.92 ± 0.91	0.233

fT4 (ng/mL)	1.18 ± 0.25	1.14 ± 0.23	0.240
Anti-TG (IU/mL)	27.40 ± 6.30	21.80 ± 5.60	<0.001
Anti-TPO (IU/mL)	53.20 ± 9.10	13.80 ± 7.20	<0.001

Statistically significant: p<0.05.

Anti-TG positivity was 31.0% in the PCOS group compared with 12.0% among controls. Anti-TPO positivity was 39.0% compared with 14.0%, respectively. These differences suggest a stronger association for anti-TPO than anti-TG (table 3).

Table 2: Prevalence of thyroid autoantibody positivity

Autoantibody	PCOS (n=100)	Control (n=100)	OR	p value
Anti-TG positive	31 (31.0%)	12 (12.0%)	3.29	0.002
Anti-TPO positive	39 (39.0%)	14 (14.0%)	3.93	<0.001

Odds ratios are unadjusted estimates.

Discussion: The principal finding of this case-control analysis is that euthyroid women with PCOS demonstrate a higher burden of thyroid autoantibodies than euthyroid controls while maintaining broadly comparable TSH and free T4 concentrations. This pattern is consistent with the concept that thyroid autoimmunity can precede overt biochemical thyroid dysfunction.

The metabolic findings also follow the established phenotype of PCOS. BMI and HOMA-IR were higher among women with PCOS, while triglycerides and LDL-C were increased and HDL-C was reduced. These findings are biologically plausible and align with the recognized association between PCOS, insulin resistance and adverse lipid profiles [2–4].

The absence of a major difference in TSH in the euthyroid population is important because thyroid autoantibody positivity does not necessarily imply current thyroid dysfunction. Earlier work in euthyroid PCOS populations similarly reported comparable TSH and free T4 but higher anti-TPO and anti-TG levels [9].

The antibody findings are supported by broader evidence. A 2018 systematic review and meta-analysis found autoimmune thyroid disease in 26.03% of women with PCOS versus 9.72% of controls, with an overall OR of 3.27. The association was also observed among Asian populations [11]. A 2022 systematic review and meta-analysis similarly concluded that PCOS and Hashimoto thyroiditis are associated [13].

More recent evidence strengthens the relevance of measuring antibody burden rather than relying solely on thyroid hormone concentrations. A 2024 meta-analysis reported significant associations of PCOS with autoimmune thyroid disease and higher anti-TPO and anti-TG levels [12]. A 2025 systematic review and meta-analysis including 40 observational studies found higher anti-TPO and anti-TG prevalence and levels in PCOS overall, although prevalence differences were attenuated in TSH- and BMI-matched subgroups, emphasizing the potential contribution of these confounders [14].

Evidence published in 2026 also supports the clinical relevance of this relationship. A recent meta-analysis reported higher prevalence of Hashimoto thyroiditis among women with PCOS and higher HOMA-IR among women with PCOS with concomitant Hashimoto thyroiditis, while lipid differences between PCOS subgroups were less consistent [15]. Thus, thyroid autoimmunity may intersect with the metabolic phenotype of PCOS, but the magnitude and independence of the association require careful adjustment for BMI, TSH, age and other metabolic factors.

Potential mechanisms include shared genetic susceptibility, immune dysregulation, chronic low-grade inflammation and interactions among reproductive hormones, adiposity and thyroid autoimmunity. However, causal inference cannot be made from a case-control design, and the literature remains heterogeneous with respect to antibody thresholds, PCOS diagnostic criteria, ethnicity and adjustment for BMI and TSH [12–15].

From a clinical perspective, the findings support awareness of thyroid autoimmunity in women with PCOS even when thyroid function tests are normal. However, the decision to perform antibody testing routinely should be based on the clinical context, guideline recommendations, laboratory reference ranges and the potential consequences of detecting antibody positivity. Prospective studies are needed to determine whether antibody-positive euthyroid women with PCOS have a higher subsequent risk of thyroid dysfunction or reproductive complications.

Limitations

• The design is cross-sectional/case-control and cannot establish causality or temporal sequence.

• Antibody cut-offs and assay-specific reference ranges would need to be confirmed from the actual laboratory platform before use in real research.
• The model does not assess longitudinal thyroid dysfunction, pregnancy outcomes, fertility-treatment response or progression to autoimmune thyroid disease.

Conclusion: In this hospital-based case-control model, euthyroid women with PCOS showed a higher burden and prevalence of anti-TPO and anti-TG antibodies despite broadly comparable TSH and free T4 levels. The pattern is consistent with published evidence suggesting an association between PCOS and thyroid autoimmunity.

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