

## An Evaluation of Thyroperoxidase Antibody in Antenatal Mothers with Hypothyroidism to Assess the Prevalence of Autoimmune Thyroiditis in Perambalur District, Tamil Nadu

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### Abstract

**Background:** Hypothyroidism during pregnancy poses significant risks to maternal and fetal health, with autoimmune thyroiditis (Hashimoto's thyroiditis) being a leading cause in iodine-sufficient regions. Thyroperoxidase (TPO) antibodies serve as a key marker for autoimmune thyroid disease. This study aimed to evaluate the prevalence of TPO antibody positivity in hypothyroid antenatal women in Perambalur district, Tamil Nadu, India.

**Methods:** A cross-sectional observational study was conducted from July 2017 to July 2018 at Dhanalakshmi Srinivasan Medical College and Hospital. Eighty antenatal women aged 18-30 years with newly diagnosed hypothyroidism (TSH >10  $\mu$ IU/mL) were included. Serum levels of total T3 (TT3), total T4 (TT4), thyroid-stimulating hormone (TSH), and TPO antibodies were measured using enzyme-linked immunosorbent assay (ELISA). Participants were categorized into TPO-positive ( $\geq 50$  IU/mL) and TPO-negative groups. Demographic data, thyroid profiles, and correlations were analyzed using descriptive statistics and Pearson's correlation.

**Results:** Of the 80 participants, 47 (58.75%) were TPO-positive. The mean age was  $25.55 \pm 5.09$  years in the TPO-positive group and  $26.03 \pm 4.87$  years in the TPO-negative group ( $p > 0.05$ ). TPO-positive women had significantly higher TSH ( $22.68 \pm 6.15$   $\mu$ IU/mL vs.  $17 \pm 4.4$   $\mu$ IU/mL;  $p < 0.01$ ) and lower TT3 ( $0.6 \pm 0.2$  ng/mL vs.  $0.8 \pm 0.4$  ng/mL;  $p < 0.01$ ) and TT4 ( $2.9 \pm 1$   $\mu$ g/dL vs.  $3.3 \pm 1.2$   $\mu$ g/dL;  $p < 0.01$ ). A strong positive correlation was observed between TPO antibodies and TSH ( $r = 0.7$ ,  $R^2 = 0.49$ ;  $p < 0.01$ ). TPO-positive women had higher rates of family history of thyroid dysfunction (40% vs. 33%) and past miscarriages (25.5% vs. 18%;  $p < 0.01$  for miscarriages).

**Conclusion:** The prevalence of Hashimoto's thyroiditis in hypothyroid antenatal women in this region is high (58.75%), underscoring the need for routine TPO antibody screening in early pregnancy to mitigate adverse outcomes. Universal screening and early intervention could improve maternal and fetal health.

**Keywords:** Hypothyroidism, Pregnancy, Thyroperoxidase Antibodies, Hashimoto's Thyroiditis, Autoimmune Thyroid Disease, Thyroid Function Tests, Antenatal Care.

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### Introduction

Pregnancy induces profound physiological changes in thyroid function, including a 50% increase in thyroid hormone production and iodine requirements due to fetal demands and maternal adaptations [1, 2]. Human chorionic gonadotropin (hCG) peaks in the first trimester, exerting thyrotropic effects that elevate free thyroxine (FT4)

and suppress thyroid-stimulating hormone (TSH) [3]. Elevated thyroxine-binding globulin (TBG) and relative iodine deficiency further complicate thyroid homeostasis [4, 5]. In women with pre-existing thyroid dysfunction or those developing hypothyroidism during pregnancy, these changes can exacerbate risks, leading to adverse outcomes

such as spontaneous abortion, gestational hypertension, placental abruption, preterm delivery, low birth weight, fetal distress, and perinatal mortality [6, 7].

Maternal hypothyroidism in the first trimester is particularly detrimental to fetal brain development, as the fetus relies on maternal thyroid hormones until approximately 12 weeks of gestation, potentially resulting in neurodevelopmental impairments [8].

While iodine deficiency remains a global cause of hypothyroidism, in iodine-sufficient areas like parts of India, autoimmune thyroiditis—predominantly Hashimoto's thyroiditis—predominates [9]. Hashimoto's thyroiditis involves autoantibodies against thyroid peroxidase (TPO), an enzyme crucial for thyroid hormone synthesis [10]. TPO antibody positivity increases the risk of postpartum thyroiditis by 5-7 times and aggravates pregnancy complications [11].

Given the high burden of hypothyroidism in Indian pregnant women (reported at 13.35%) and the association with autoimmune etiology [12], this study investigates TPO antibody prevalence in hypothyroid antenatal women to assess autoimmune thyroiditis in a rural district of Tamil Nadu.

**Aim:** To determine the prevalence of Hashimoto's thyroiditis among antenatal hypothyroid women in and around Perambalur district, Tamil Nadu.

### Objectives

1. To screen thyroid function tests (TFTs), including total T3 (TT3), total T4 (TT4), and TSH, in antenatal mothers attending the Obstetrics Outpatient Department (OPD) at Dhanalakshmi Srinivasan Medical College and Hospital.
2. To assess TPO antibody levels in hypothyroid antenatal mothers and determine the prevalence of Hashimoto's thyroiditis in the study population.

### Materials and Methods

**Study Design and Setting:** This cross-sectional observational study was conducted from July 2017 to July 2018 at the Department of Biochemistry in collaboration with the Department of Obstetrics and Gynecology, Dhanalakshmi Srinivasan Medical College and Hospital, Perambalur, Tamil Nadu, India.

### Participants

Eighty antenatal women with newly diagnosed hypothyroidism (TSH >10  $\mu$ IU/mL) were recruited consecutively from the Obstetrics OPD. Inclusion criteria: Age 18-30 years, gestational age up to 28 weeks, and confirmed hypothyroidism. Exclusion criteria: Known pre-existing hypothyroidism or other thyroid disorders.

**Ethical Considerations:** The study was approved by the Institutional Ethical Committee. Written informed consent was obtained from all participants after explaining the study purpose.

**Sample Collection and Analysis:** Fasting venous blood (5 mL) was collected in red-topped tubes under aseptic conditions. Serum was separated by centrifugation at 3500 rpm for 10 minutes and stored at -20°C until analysis.

### Thyroid Function Tests

TT3, TT4, and TSH were measured using ELISA kits (specific methodologies as follows):

- **TT3:** Competitive ELISA with goat anti-mouse antibody-coated microwells; absorbance at 450 nm inversely proportional to TT3 concentration.
- **TT4:** Competitive ELISA with sheep anti-T4 antibody-coated microwells; absorbance at 450 nm inversely proportional to TT4 concentration.
- **TSH:** Sandwich ELISA with anti-TSH monoclonal antibody-coated microwells; absorbance at 450 nm proportional to TSH concentration.

**TPO Antibody Estimation:** ELISA using antigen-coated microwells. Patient serum was incubated, followed by HRP-conjugated secondary antibody and TMB substrate. Absorbance at 450 nm was proportional to TPO antibody concentration. Cut-off for positivity:  $\geq 50$  IU/mL.

**Statistical Analysis:** Data were analyzed using SPSS version 25.0. Descriptive statistics (mean  $\pm$  SD) were used for continuous variables. Independent t-tests compared groups, and Pearson's correlation assessed relationships.  $P < 0.05$  was considered significant.

### Results

Eighty antenatal women were enrolled, with 47 (58.75%) TPO-positive and 33 (41.25%) TPO-negative.

**Table 1: Demographic Characteristics of the Study Population**

Parameters	TPO-Positive Hypothyroid Pregnant Women (n=47)	TPO-Negative Hypothyroid Pregnant Women (n=33)	P-Value
Age (years)	25.55 ± 5.09	26.03 ± 4.87	NS
BMI (kg/m <sup>2</sup> )	25.8 ± 3.2	24.2 ± 2.8	<0.05
Mean Gestational Age (weeks)	11.51 ± 6.59	12.3 ± 7.7	NS
Family History of Hypothyroidism (%)	19 (40%)	11 (33%)	NS
Past History of Miscarriages (%)	12 (25.5%)	6 (18%)	<0.01
Socioeconomic Status: Below Poverty Line / Above Poverty Line (%)	27 (57%) / 20 (43%)	19 (58%) / 14 (42%)	NS

NS: Not significant.

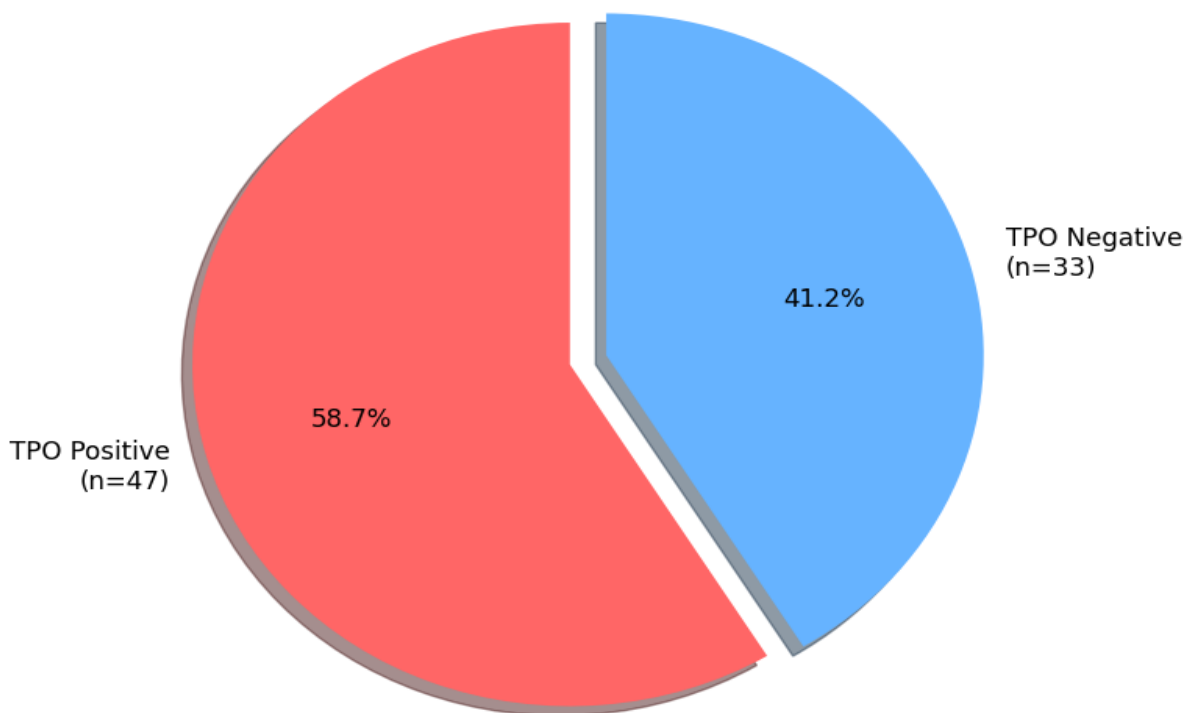
**Table 2: Comparison of Thyroid Profile and TPO Antibody Levels**

Parameters	TPO-Positive (n=47)	TPO-Negative (n=33)	P-Value
TT3 (ng/mL)	0.6 ± 0.2	0.8 ± 0.4	<0.01
TT4 (µg/dL)	2.9 ± 1	3.3 ± 1.2	<0.01
TSH (µIU/mL)	22.68 ± 6.15	17 ± 4.4	<0.01
TPO Ab (IU/mL)	323.58 ± 238.68	12.08 ± 8.35	<0.01

**Table 3: Correlation between Anti-TPO and Thyroid Hormones in TPO-Positive Group**

Thyroid Hormones	r	R <sup>2</sup>	P-Value
TT3	-0.44	0.1967	<0.01
TT4	-0.58	0.3364	<0.01
TSH	0.7	0.49	<0.01

**Prevalence of TPO Antibody Positivity among Hypothyroid Antenatal Women (n=80)**



**Figure 1: Figure 1. Prevalence of Thyroperoxidase Antibody Positivity among Hypothyroid Antenatal Women**

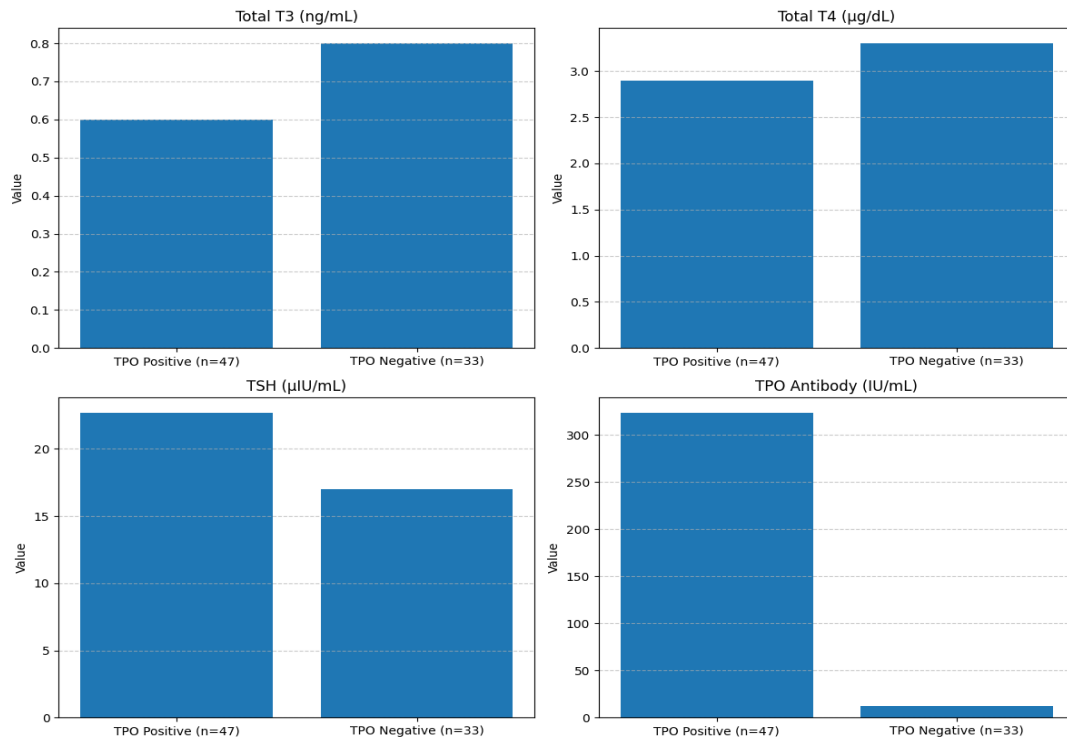
In the present study, more than half of the hypothyroid antenatal women demonstrated evidence of autoimmune thyroid disease. As shown

in Figure 1, 58.75% (n = 47) of the participants were positive for thyroperoxidase (TPO) antibodies, while 41.25% (n = 33) were TPO-

negative. This finding indicates a high burden of autoimmune (Hashimoto's) thyroiditis among

hypothyroid pregnant women in the study population.

Comparison of Thyroid Parameters between TPO Positive and TPO Negative Groups



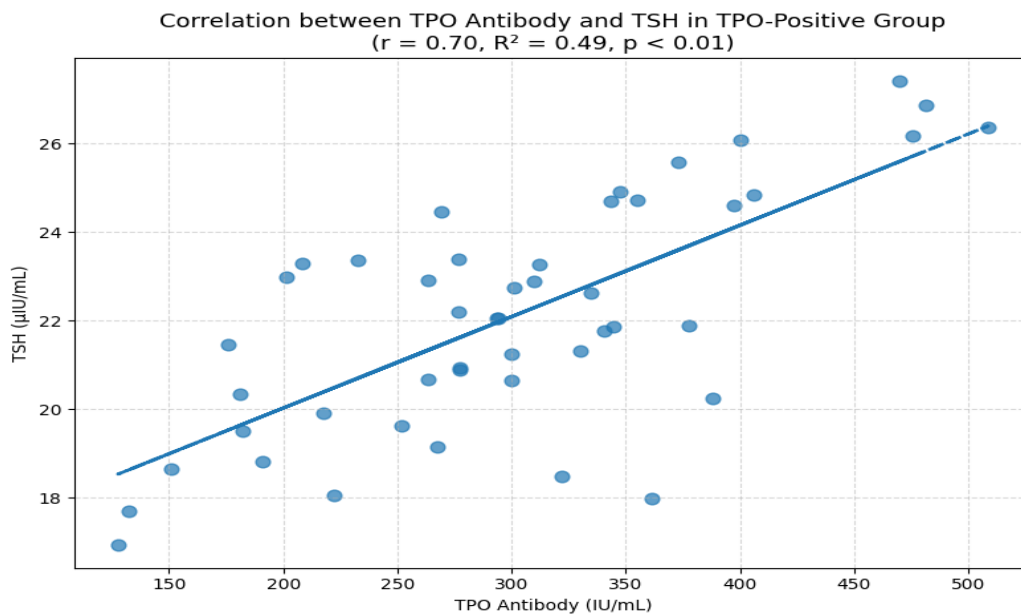
**Figure 2: Comparison of Thyroid Function Parameters and TPO Antibody Levels between TPO-Positive and TPO-Negative Groups**

A comparison of thyroid function parameters between TPO-positive and TPO-negative groups revealed significant biochemical differences.

As illustrated in Figure 2, the TPO-positive group exhibited lower mean total T3 (TT3) and total T4 (TT4) levels, along with markedly higher thyroid-stimulating hormone (TSH) concentrations

compared to the TPO-negative group. Additionally, TPO antibody titers were substantially elevated in the TPO-positive group.

All observed differences were statistically significant ( $p < 0.01$ ), suggesting more severe hypothyroidism in women with autoimmune etiology.



**Figure 3: Correlation between Serum Anti-TPO Antibody Levels and TSH in TPO-Positive Hypothyroid Antenatal Women**

Correlation analysis demonstrated a significant positive association between serum anti-TPO antibody levels and TSH concentrations among TPO-positive participants. As depicted in Figure 3, higher TPO antibody titers were associated with progressively elevated TSH levels, showing a moderate to strong correlation (Pearson's  $r = 0.70$ ,  $R^2 = 0.49$ ;  $p < 0.01$ ). This dose-response relationship indicates that increasing autoimmune activity is linked to greater thyroid dysfunction.

#### Significance of Results

The high prevalence of TPO positivity (58.75%) indicates that autoimmune thyroiditis is a major contributor to hypothyroidism in this population, aligning with global trends in iodine-sufficient areas [9]. Elevated TSH and reduced TT3/TT4 in TPO-positive women signify more severe thyroid dysfunction, with the strong TSH-TPO correlation ( $r=0.7$ ) suggesting progressive autoimmune damage [13]. Higher miscarriage rates in TPO-positive groups highlight clinical risks [14]. These findings are significant for rural Indian settings, where access to screening is limited, emphasizing autoimmune etiology over iodine deficiency.

#### Discussion

This study reveals a 58.75% prevalence of Hashimoto's thyroiditis in hypothyroid antenatal women, higher than reported in some Indian studies (e.g., 40% by Dhanwal et al., 2016 [12]) but comparable to global estimates (45.8% meta-analysis by Collett et al., 2012 [16]).

The elevated TSH in TPO-positive group's mirrors findings from the Tehran Thyroid Study [17] and HUNT Study [18], indicating autoimmune progression. Demographic similarities across

groups suggest autoimmune risk transcends age and socioeconomic status, though higher BMI in TPO-positive women aligns with obesity-autoimmunity links [19]. Family history and miscarriage associations reinforce genetic and clinical implications [20, 21]. Pathophysiologically, TPO antibodies disrupt thyroid hormone synthesis, exacerbating pregnancy demands [10]. Compared to Vaidya et al. (2007) [22] (40% positivity) and Gayathri et al. (2007) [23] (8.69% in Chennai), our rural cohort shows higher rates, possibly due to environmental factors like iodine excess [24].

Universal screening, as recommended over targeted approaches (missing 30% cases) [25], could mitigate risks, supported by Negro et al. (2010) showing reduced adverse outcomes with treatment.

Future research should include iodine assays, genetic profiling, and outcome tracking to refine interventions.

**Recommendations:** Implement universal TPO antibody screening in early antenatal care to identify at-risk women. Early levothyroxine therapy could reduce complications [15]. Public health initiatives should promote iodine sufficiency while monitoring autoimmune triggers.

**Limitations:** The study was hospital-based with a small sample ( $n=80$ ), potentially introducing selection bias. It lacked longitudinal follow-up for pregnancy outcomes and did not assess iodine status or genetic factors. Larger, multicenter studies are needed.

#### Conclusion

Hashimoto's thyroiditis prevails in 59% of hypothyroid antenatal women in Perambalur,

warranting routine TPO screening for improved maternal-fetal outcomes.

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