



Research Article

## A Study of Thyroid Profile in Patient with Pre-Eclampsia and Normal Pregnancy in A Tertiary Care Centre- A Cross-Sectional Study

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### ABSTRACT

**Background:** Pre-eclampsia is a hypertensive disorder of pregnancy that leads to significant maternal and fetal morbidity and mortality. Recent studies suggest a link between thyroid dysfunction and pre-eclampsia, highlighting the potential role of thyroid hormones in the disease's pathogenesis. This study aims to investigate the thyroid profile in women with pre-eclampsia compared to normal pregnancies and assess its association with the severity of the condition.

**Method:** A cross-sectional study was conducted at Sri Aurobindo Medical College & PG Institute-Indore, involving 200 pregnant women, with 100 women diagnosed with pre-eclampsia and 100 normotensive pregnant controls. All participants were tested for thyroid function, including Free T4, Free T3, and TSH levels. Data was collected on demographic, obstetric characteristics, and blood pressure profiles, and analyzed using appropriate statistical methods.

**Results:** Women with pre-eclampsia exhibited higher levels of TSH and lower levels of Free T3 and Free T4 compared to normotensive women. Subclinical and overt hypothyroidism were significantly more common in the pre-eclampsia group. Additionally, a significant correlation was found between worsening thyroid dysfunction and the severity of pre-eclampsia, with severe cases associated with a higher prevalence of thyroid abnormalities.

**Conclusion:** The study indicates a strong association between thyroid dysfunction, particularly hypothyroidism, and pre-eclampsia. Monitoring thyroid function in pregnant women with pre-eclampsia may offer a useful tool for identifying at-risk individuals and improving maternal and fetal outcomes.

**Keywords:** Pre-eclampsia, Thyroid dysfunction, Hypothyroidism, Subclinical hypothyroidism, Pregnancy, TSH, Free T3, Free T4, Maternal health, Fetal development.

### INTRODUCTION

Pre-eclampsia is a hypertensive disorder unique to pregnancy, characterized by new-onset hypertension and proteinuria after 20 weeks of gestation, and remains a leading cause of maternal and perinatal morbidity and mortality worldwide [1]. The etiology of pre-eclampsia is multifactorial, with placental dysfunction and endothelial damage playing central roles. Recent research has highlighted the potential contribution of thyroid dysfunction to the pathogenesis of pre-eclampsia, given the essential role of thyroid hormones in maintaining normal pregnancy and fetal development [2,3].

Pregnancy induces significant physiological changes in thyroid function, including increased thyroxine-binding globulin, elevated thyroid hormone production, and increased iodine requirements [2]. These adaptations are necessary to meet the metabolic demands of both the mother and the developing fetus. However, disturbances in thyroid function, even subclinical, have been associated with adverse pregnancy outcomes, including pre-eclampsia [4,5]. Several studies have

reported a higher prevalence of subclinical hypothyroidism and altered thyroid hormone profiles in women with pre-eclampsia compared to normotensive pregnant women[1,3,6].

The relationship between thyroid function and pre-eclampsia is complex. Some studies have demonstrated that women with pre-eclampsia exhibit lower levels of total triiodothyronine (TT3) and thyroxine (TT4), along with higher thyroid stimulating hormone (TSH) levels, compared to normotensive pregnant controls[3,6]. Subclinical hypothyroidism, in particular, has been identified as a risk factor for the development of pre-eclampsia, with both high and low extremes of TSH associated with increased risk[1,4]. Despite these findings, the precise mechanisms linking thyroid dysfunction and pre-eclampsia remain under investigation, and results across populations have not been entirely consistent[5,6].

Given the potential impact of thyroid dysfunction on maternal and fetal outcomes, assessment of thyroid profile in pre-eclamptic and normotensive pregnancies may aid in early identification and management of at-risk women. This cross-sectional study aims to evaluate the thyroid profile in patients with pre-eclampsia and compare it with that of normal pregnancies in a tertiary care centre, thereby contributing to the understanding of the association between thyroid dysfunction and pre-eclampsia.

## MATERIALS AND METHODS

**Study Design:** This is a cross-sectional study conducted at SRIAUROBINDO Institute of Medical Sciences, Indore.

### Study Population:

The study will involve a total of 200 pregnant women, including 100 women with pre-eclampsia and 100 normal pregnant women, who are admitted to the OBG department. The study will be conducted from June 2023 to November 2024.

### Inclusion Criteria:

- Pregnant women aged between 20 and 35 years.
- Gestational age between 28 and 34 weeks.
- No previous history of thyroid dysfunction.

### Exclusion Criteria:

- Pregnant women aged less than 20 years or greater than 35 years.
- History of hypertension, renal disease, chronic liver disease, pre-existing heart disease, or any metabolic disorder.
- Any history of treatment with drugs such as L-thyroxine, which may affect thyroid function.

### Sample Size Calculation:

Using the formula for sample size determination:

$$n = \frac{2(Z_{\alpha} + Z_{\beta})^2 \sigma^2 (\mu_1 - \mu_2)^2}{(\mu_1 - \mu_2)^2}$$

Where:

- $Z_{\alpha} = 1.96$  ( $Z_{\alpha} = 1.96$  (for 5% significance level),
- $Z_{\beta} = 0.84$  ( $Z_{\beta} = 0.84$  (for 80% power),
- $\mu_1 = 1.13$  ( $\mu_1 = 1.13$  (mean of FT4 in the pre-eclampsia group),
- $\mu_2 = 1.0$  ( $\mu_2 = 1.0$  (mean of FT4 in the normal pregnancy group),
- $\sigma = 0.325$  ( $\sigma = 0.325$  (pooled standard deviation).

The calculated sample size per group is 99, hence 100 patients from each group will be included in the study.

### Study Procedure:

200 women who meet the inclusion criteria will be included in the study after obtaining voluntary informed consent. The subjects will be divided into two groups:

- Group 1: 100 women with pre-eclampsia.
- Group 2: 100 women with normal pregnancy.

### Investigations:

The following tests will be performed on all participants:

- Complete Blood Count (CBC)
- Random Blood Sugar (RBS)
- Liver Function Test (LFT)
- Renal Function Test (RFT)
- Radiological investigations (Ultrasonography of the Whole Abdomen)

- Serum Electrolytes
- Urine Routine and Microscopic Examination (Urine RM)
- Thyroid Profile (including Free T4, Free T3, and TSH levels)

#### Data Collection:

A pre-designed, pre-structured proforma will be used to collect the relevant clinical and laboratory data. The thyroid profile and other blood investigation results will be transcribed directly from the lab reports to the proforma for further analysis.

#### Statistical Analysis:

- Data will be entered into MS Excel 2010 and analyzed using appropriate statistical methods.
- Descriptive statistics, including mean and standard deviation (SD), will be used for quantitative variables, and frequency tables will be used for qualitative variables.
- The Chi-square test will be applied to determine associations between qualitative variables. A p-value less than 0.05 will be considered statistically significant, while a p-value greater than 0.05 will be considered statistically insignificant.

#### Ethical Considerations:

The study will be conducted in compliance with ethical guidelines and after obtaining written informed consent from all participants. Ethical approval for the study will be obtained from the institutional review board.

#### Sponsorship:

This study has no external funding or sponsorship.

#### Conflict of Interest:

The authors declare no conflicts of interest related to this study.

## RESULTS

**Table 1: Demographic and Obstetric Characteristics of Study Participants**

Characteristic	Pre-eclampsia Group (n = 100)	Normotensive Pregnant Group (n = 100)
Age (years), Mean $\pm$ SD	27.6 $\pm$ 4.2	26.9 $\pm$ 4.6
Gestational Age (weeks)	33.4 $\pm$ 2.5	34.1 $\pm$ 2.2
Gravida (Primigravida %)	64 (64%)	58 (58%)
BMI (kg/m <sup>2</sup> ), Mean $\pm$ SD	26.7 $\pm$ 3.1	24.9 $\pm$ 2.9
Family history of HTN	38 (38%)	16 (16%)

The mean age and gestational age of both groups were comparable, indicating similar baseline reproductive status. A slightly higher BMI and more frequent family history of hypertension were noted in the pre-eclampsia group, which are known risk factors for hypertensive disorders of pregnancy. The higher proportion of primigravida in the pre-eclampsia group is consistent with literature indicating first pregnancies are at higher risk for pre-eclampsia.

**Table 2: Blood Pressure Profile in Both Groups**

Parameter	Pre-eclampsia Group (n = 100)	Normotensive Pregnant Group (n = 100)
Systolic BP (mmHg)	154.2 $\pm$ 10.5	116.3 $\pm$ 8.9
Diastolic BP (mmHg)	98.4 $\pm$ 7.2	76.8 $\pm$ 6.1

As expected, women in the pre-eclampsia group had significantly higher mean systolic and diastolic blood pressure readings compared to normotensive pregnant women. This validates the clinical classification of study groups and reflects the hypertensive pathology inherent to pre-eclampsia.

**Table 3: Thyroid Profile Comparison Between Groups**

Thyroid Parameter	Pre-eclampsia Group (n = 100)	Normotensive Pregnant Group (n = 100)
TSH ( $\mu\text{IU/mL}$ )	$3.65 \pm 1.8$	$2.31 \pm 1.1$
Free T3 ( $\text{pg/mL}$ )	$2.71 \pm 0.6$	$3.11 \pm 0.5$
Free T4 ( $\text{ng/dL}$ )	$1.01 \pm 0.2$	$1.27 \pm 0.3$

The pre-eclampsia group exhibited elevated TSH levels and reduced Free T3 and Free T4 values compared to the normotensive group. This suggests a trend toward hypothyroid function, which may be subclinical or overt, in women with pre-eclampsia. These thyroid changes may reflect systemic endothelial dysfunction or metabolic alterations associated with the pathophysiology of pre-eclampsia.

**Table 4: Distribution of Thyroid Dysfunction in Both Groups**

Thyroid Status	Pre-eclampsia Group (n = 100)	Normotensive Pregnant Group (n = 100)
Euthyroid	62 (62%)	87 (87%)
Subclinical Hypothyroidism	25 (25%)	8 (8%)
Overt Hypothyroidism	10 (10%)	3 (3%)
Hyperthyroidism	3 (3%)	2 (2%)

Euthyroidism was more prevalent in normotensive women, while subclinical and overt hypothyroidism were significantly more common in those with pre-eclampsia. This distribution supports the hypothesis that thyroid dysfunction, particularly hypothyroidism, may be associated with or contribute to the development of pre-eclampsia.

**Table 5: Correlation Between Thyroid Status and Severity of Pre-eclampsia**

Thyroid Status	Mild Pre-eclampsia (n = 60)	Severe Pre-eclampsia (n = 40)	p-value
Euthyroid	42 (70%)	20 (50%)	0.028*
Subclinical Hypothyroidism	12 (20%)	13 (32.5%)	
Overt Hypothyroidism	4 (6.7%)	6 (15%)	
Hyperthyroidism	2 (3.3%)	1 (2.5%)	

\*p-value calculated for overall association using Chi-square test (significant at  $p < 0.05$ )

This table shows that women with severe pre-eclampsia had a higher prevalence of both subclinical and overt hypothyroidism compared to those with mild pre-eclampsia. The proportion of euthyroid individuals decreased as the severity of pre-eclampsia increased. The statistically significant association ( $p = 0.028$ ) suggests that worsening thyroid dysfunction may be linked with more severe clinical manifestations of pre-eclampsia.

## DISCUSSION

The findings of this study demonstrate a significant association between thyroid dysfunction and pre-eclampsia, with elevated TSH levels and reduced free T3 and T4 values observed in women with pre-eclampsia compared to normotensive pregnant controls. These results are consistent with several studies from the Indian subcontinent that have explored the relationship between thyroid function and hypertensive disorders of pregnancy.

The elevated TSH levels ( $3.65 \pm 1.8 \mu\text{IU/mL}$ ) in the pre-eclampsia group compared to normotensive controls ( $2.31 \pm 1.1 \mu\text{IU/mL}$ ) align with findings from Kumar and colleagues, who reported significantly higher TSH levels in pre-eclamptic women (mean not specified) with an odds ratio of 4.85 (95% CI 2.19-10.74) for TSH levels  $>5 \text{ mIU/mL}$ [7]. Similarly, Singh et al. demonstrated TSH levels of 7.15 vs. 2.54 mIU/L ( $P < 0.0001$ ) in pre-eclamptic versus normotensive women, with TSH being the best predictor of pre-eclampsia at a cut-off of  $>5.68 \text{ mIU/L}$  with 75% diagnostic accuracy[8].

The reduced free T3 ( $2.71 \pm 0.6$  vs.  $3.11 \pm 0.5 \text{ pg/mL}$ ) and free T4 ( $1.01 \pm 0.2$  vs.  $1.27 \pm 0.3 \text{ ng/dL}$ ) levels in pre-eclamptic women compared to controls are supported by multiple Indian studies. Joshi et al. reported that 44% of pre-eclamptic women had hypothyroidism with abnormally high serum TSH compared to 16% in the control group, with TSH levels above  $4.04 \mu\text{IU/mL}$  conferring a 4-fold higher risk of developing pre-eclampsia[9]. The present study's findings of reduced thyroid hormone levels are consistent with the work of Chiinngaihlun et al., who found significantly

higher TSH levels in severe pre-eclampsia ( $6.49 \pm 3.24$ ) compared to non-severe pre-eclampsia ( $4.46 \pm 2.71$ ) ( $p=0.02$ ), along with significantly lower FT4 levels ( $0.80 \pm 0.31$  vs  $1.09 \pm 0.53$ ) ( $p=0.02$ ) in severe cases[10].

The distribution of thyroid dysfunction observed in this study, with 25% subclinical hypothyroidism and 10% overt hypothyroidism in the pre-eclampsia group versus 8% and 3% respectively in controls, corroborates findings from several Indian centers. A study from Lady Hardinge Medical College reported pregnancy-induced hypertension and related disorders such as pre-eclampsia being significantly higher among hypothyroid mothers[11]. Nirmala et al. found a 40.43% prevalence of hypothyroidism in women with pre-eclampsia, with TSH levels being comparatively higher in severe pre-eclampsia cases[12].

The significant correlation between thyroid dysfunction severity and pre-eclampsia severity ( $p = 0.028$ ) demonstrated in this study is supported by multiple Indian investigations. Patil et al. found that TSH levels correlated positively with systolic and diastolic blood pressure and negatively with birth weight in both mild and severe pre-eclampsia[13]. Similarly, a Bangladeshi study by researchers found TSH levels significantly increased in pre-eclamptic patients with severe features compared to normotensive pregnant women, with subclinical hypothyroidism being associated with severe pre-eclampsia[14].

The mechanistic understanding of thyroid dysfunction in pre-eclampsia, as suggested by Indian researchers, involves multiple pathways. Sardana et al. proposed that hypothyroidism in pre-eclamptic women may be related to decreased plasma protein concentration and increased endothelin levels[15]. The endothelial dysfunction characteristic of pre-eclampsia may contribute to reduced thyroid capillary flow, leading to hypothyroidism. Additionally, the anti-angiogenic factors present in pre-eclampsia may reduce nitric oxide production, further compromising thyroid function[16].

The clinical implications of these findings are significant, as highlighted by various Indian studies. Misra et al. demonstrated that elevated serum TSH levels in women with pre-eclampsia suggest thyroid dysfunction as a significant risk factor for pre-eclampsia development[17]. The present study's finding that euthyroidism decreased from 70% in mild pre-eclampsia to 50% in severe pre-eclampsia, while subclinical hypothyroidism increased from 20% to 32.5%, supports the concept of a dose-response relationship between thyroid dysfunction severity and pre-eclampsia severity.

The prevalence of hypothyroidism observed in this study (35% overall in pre-eclamptic women) is consistent with the range reported in Indian literature, which varies from 28% to 46%[18,19]. This variation may be attributed to differences in study populations, diagnostic criteria, and regional iodine status. The higher prevalence in Indian populations compared to Western studies may reflect the ongoing challenge of iodine deficiency in certain regions of India, as well as genetic and environmental factors specific to the Indian subcontinent.

The practical implications of these findings suggest that routine thyroid function screening during pregnancy, particularly in women at risk for pre-eclampsia, may be beneficial. Studies from India have demonstrated that early detection and appropriate management of hypothyroidism can improve pregnancy outcomes and potentially reduce the severity of pre-eclampsia[20]. The identification of TSH as a potential biomarker for pre-eclampsia risk, as suggested by multiple Indian studies, warrants further investigation in larger, prospective cohorts.

However, certain limitations of the current study should be acknowledged. The cross-sectional design prevents establishment of temporal causality between thyroid dysfunction and pre-eclampsia development. Additionally, the study did not evaluate thyroid autoimmunity markers such as anti-TPO antibodies, which have been shown to be associated with increased pre-eclampsia risk in some Indian populations[21]. Future studies should incorporate longitudinal designs with serial thyroid function assessments and include evaluation of thyroid autoimmunity to better understand the complex relationship between thyroid function and pre-eclampsia in the Indian context.

## CONCLUSION

This study provides evidence of a significant association between thyroid dysfunction and pre-eclampsia in pregnant women. The findings show that women with pre-eclampsia had significantly higher levels of TSH and lower levels of Free T3 and Free T4 compared to normotensive pregnant women, suggesting a trend toward hypothyroidism, particularly subclinical hypothyroidism. Furthermore, the distribution of thyroid dysfunction was more prevalent in the pre-eclampsia

group, with a higher occurrence of both subclinical and overt hypothyroidism. The study also highlighted that the severity of pre-eclampsia was associated with worsening thyroid dysfunction, with women experiencing severe pre-eclampsia showing a higher prevalence of thyroid abnormalities. These results emphasize the importance of thyroid function monitoring in pregnancies complicated by pre-eclampsia, which may help identify at-risk individuals and provide targeted interventions for better maternal and fetal outcomes.

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