e-ISSN: 0975-5160, p-ISSN: 2820-2651

Available online on www.ijtpr.com

International Journal of Toxicological and Pharmacological Research 2024; 14 (10); 130-134

Original Research Article

Impact of Pre-eclampsia and Eclampsia on Thyroid Function Compared to Normal Pregnancy

Satani Drumil Rasikbhai[1], Chavda Bhargav Sanjaybhai[2], Virsodiya Dhara Mukeshbhai[3], Kachrola Jaydeep Popatlal[4]

[1,3]Tutor, Department of Biochemistry, GMERS Medical College, Morbi, Gujarat
[2,4]Tutor, Department of Pharmacology, GMERS Medical College, Morbi, Gujarat

Received: 18-07-2024 / Revised: 21-08-2024 / Accepted: 26-09-2024
Corresponding author: Dr. Kachrola Jaydeep Popatlal
Conflict of interest: Nil

Abstract:

Background: Pre-eclampsia and eclampsia are significant hypertensive disorders in pregnancy that can affect maternal thyroid function, potentially leading to adverse outcomes. This study aims to assess the impact of pre-eclampsia and eclampsia on thyroid function compared to normal pregnancies.

Material and Methods: A total of 200 pregnant women were included, with 100 in the pre-eclampsia/eclampsia group and 100 in the normotensive group. Clinical data, including blood pressure and thyroid profiles (TSH, T3, and T4), were collected during the third trimester. Thyroid function was analyzed using chemiluminescent immunoassays, and statistical comparisons were made between the groups.

Results: In our study, case group showed significantly higher blood pressure (SBP: 150.00 vs. 120.04 mmHg; DBP: 101.00 vs. 79.36 mmHg, $P < 0.001$) and elevated urine albumin levels ($P < 0.001$). Thyroid function analysis revealed higher serum TSH (4.32 vs. 1.98 mIU/L) and T T3 levels (2.25 vs. 1.45 ng/mL) in the case group, with P values <0.001 and 0.010, respectively, while T T4 levels were comparable ($P = 0.639$). Hypothyroidism was more prevalent in the case group (30%) compared to the control group (10%, $P = 0.001$).

Conclusion: Pre-eclampsia and eclampsia significantly impact thyroid function, with higher TSH and T3 levels and increased prevalence of hypothyroidism compared to normotensive pregnancies. Early screening and management of thyroid dysfunction in hypertensive pregnancies are essential for improving maternal and neonatal outcomes.

Keywords: Pre-eclampsia, Eclampsia, Thyroid function, Hypothyroidism, Pregnancy outcomes.

Introduction

Pre-eclampsia and eclampsia are significant complications of pregnancy, associated with maternal and fetal morbidity and mortality. [1] These hypertensive disorders affect multiple organ systems, and recent studies suggest that thyroid dysfunction may play a role in their pathophysiology. [2] Thyroid hormones are essential for the normal development of the fetus and the metabolic adaptations of the mother during pregnancy. Any alteration in thyroid function can result in adverse pregnancy outcomes. [3] Pregnancy induces several physiological changes in thyroid function, such as increased demand for thyroid hormones and altered levels of thyroid-stimulating hormone (TSH) and thyroxine (T4).4 In pre-eclampsia and eclampsia, these changes may be further exacerbated due to oxidative stress, placental dysfunction, and systemic inflammation. [5] Evaluating thyroid profiles in affected pregnancies can provide insights into the potential endocrine disruption involved and may aid in identifying subclinical thyroid dysfunctions early. Early intervention could improve maternal and neonatal outcomes by preventing complications related to thyroid imbalances. [6] This study focuses on comparing thyroid hormone levels, including TSH, T3, and T4, across pre-eclamptic or eclamptic, and healthy pregnancies.

Material and Methods

This cross-sectional study was conducted at a tertiary care center to assess the impact of pre-eclampsia and eclampsia on thyroid function compared to normal pregnancies. A total of 200 pregnant women were included in the study, divided into two groups: 100 women with pre-eclampsia or eclampsia and 100 women with uncomplicated, normal pregnancies serving as the control group. Ethical approval was obtained from the institutional ethics committee, and informed consent was secured from all participants prior to enrollment. Pregnant women aged between 18–40

years, with confirmed singleton pregnancies in their third trimester, were included in the study.

The pre-eclampsia group was identified based on hypertension (blood pressure ≥140/90 mmHg) accompanied by proteinuria (≥300 mg in a 24-hour urine sample). Eclampsia cases were diagnosed by the presence of seizures or altered mental status in the setting of pre-eclampsia.

The control group consisted of healthy pregnant women with normal blood pressure and no pregnancy-related complications. Women with pre-existing thyroid disorders, chronic hypertension, autoimmune diseases, multiple pregnancies, or those on medications affecting thyroid function were excluded to avoid bias.

Detailed demographic and clinical data were collected from each participant, including age, parity, gestational age, and medical history. All participants underwent a thorough physical examination, with emphasis on measuring blood pressure to confirm hypertensive disorders. Blood samples were collected during the third trimester from all participants to analyze thyroid profiles, which included the levels of thyroid-stimulating hormone (TSH), triiodothyronine (T3), and thyroxine (T4). Serum samples were processed in the hospital's central laboratory. Thyroid hormones (TSH, T3, and T4) were measured using chemiluminescent immunoassays (CLIA). Reference ranges for pregnancy were applied to categorize participants into euthyroid, hypothyroid, or hyperthyroid status. Any deviations from the normal range were noted, and comparisons were made between the pre-eclampsia/eclampsia group and the control group.

Data were analyzed using statistical software. Continuous variables, such as hormone levels, were presented as mean ± standard deviation and compared between the two groups using the independent t-test or Mann-Whitney U test. Categorical variables, such as thyroid status (euthyroid, hypothyroid, hyperthyroid), were compared using chi-square tests. A p-value of <0.05 was considered statistically significant.

Results

In our study of 200 pregnant women, the pre-eclampsia/eclampsia group showed lower gestational age (37.5 vs. 39 weeks), birth weight (2.15 vs. 2.7 kg), and placental weight (430 vs. 500 g) compared to the normotensive group, highlighting the impact of hypertension on pregnancy outcomes. (Table 1)

Table 1: Clinical Characteristics of Study Groups

Parameters	Preeclampsia/Eclampsia Group (Mean ± SD)	Normotensive Group (Mean ± SD)
Age (years)	23.10 ± 2.85	23.05 ± 2.20
Gestational Age (weeks)	37.50 ± 1.8	39.00 ± 1.5
Birth Weight (kg)	2.15 ± 0.45	2.70 ± 0.30
Placental Weight (g)	430.00 ± 60.00	500.00 ± 55.00

The 2 table presents the comparison between the case and control groups.
ANC weeks, pulse, and RBS levels are similar across both groups, with no significant difference. Blood pressure (both SBP and DBP) is significantly higher in the case group ($P < 0.001$). Urine albumin is notably elevated in the case group, with 36 showing 1+ levels, 2 with 2+, and 12 with 3+, while all controls had NIL albumin levels ($P < 0.001$).

Table 2: Clinical Parameters between Case and Control Groups

Parameter	Case (Mean / Total)	Control (Mean / Total)	P value
ANC Weeks	30.78 ± 1.52	30.92 ± 1.36	0.570
Systolic BP (SBP)	150.00 ± 2.89	120.04 ± 11.32	<0.001
Diastolic BP (DBP)	101.00 ± 2.18	79.36 ± 7.75	<0.001
Pulse	98.36 ± 11.06	94.12 ± 11.24	0.796
Random Blood Sugar (RBS)	118.72 ± 8.13	117.76 ± 8.65	0.597
Urine Albumin 1+	36	0	<0.001
Urine Albumin 2+	2	0	
Urine Albumin 3+	12	0	
Urine Albumin NIL	0	50	

The case group showed significantly higher serum TSH (4.32 vs. 1.98 mIU/L) and T T3 levels (2.25 vs. 1.45 ng/mL) compared to the control group, with P values <0.001 and 0.010, respectively. T T4 levels were similar between groups ($P = 0.639$).

Table 3: Thyroid Profile among study subjects

Parameter	Case (Mean)	Control (Mean)	P value
Serum TSH (mIU/L)	4.32 ± 3.85	1.98 ± 1.50	<0.001
T T3 (ng/mL)	2.25 ± 1.80	1.45 ± 0.70	0.010
T T4 (µg/dL)	10.90 ± 3.80	10.35 ± 3.10	0.639

Hypothyroidism was more prevalent in the case group (30%) than in the control group (10%), while the control group had a higher proportion of euthyroid individuals (90 vs. 70). (Figure 1)

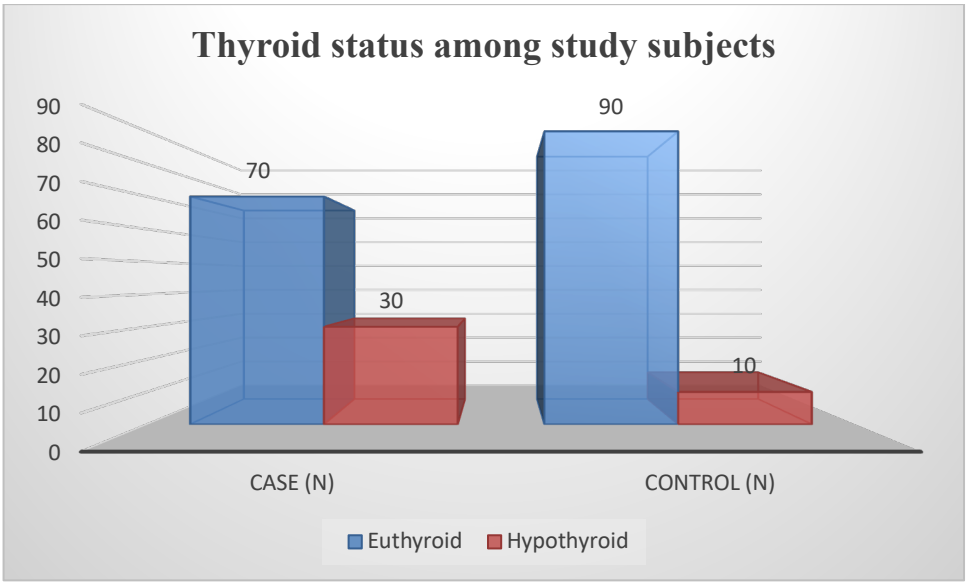

Figure 1: Thyroid status among study subjects

Discussion

In our study of 200 pregnant women, the pre-eclampsia/eclampsia group demonstrated lower gestational age (37.5 vs. 39 weeks), birth weight (2.15 vs. 2.7 kg), and placental weight (430 vs. 500 g) compared to the normotensive group, indicating the adverse effects of hypertensive disorders on pregnancy outcomes. These findings suggest that pre-eclampsia and eclampsia not only shorten the duration of pregnancy but also impair fetal growth and placental development, likely due to compromised uteroplacental blood flow and increased vascular resistance. [7,8] Early identification and management of hypertension in pregnancy are crucial to minimize these complications and improve maternal and neonatal outcomes. [9]

The case group showed significantly higher serum TSH (4.32 vs. 1.98 mIU/L) and T T3 levels (2.25 vs. 1.45 ng/mL) compared to the control group, with P values <0.001 and 0.010, respectively. T T4 levels were similar between groups (P = 0.639). This consistent duration of pregnancy across both groups allows for a reliable comparison of thyroid profiles and other parameters. Misra et al. [10] found that mean serum TSH levels were higher in preeclamptic women compared to controls, highlighting thyroid dysfunction as a significant risk factor for preeclampsia. Similarly, Gui et al. [11] revealed that severe and early onset preeclampsia, along with thyroid dysfunction, were associated with higher risks of preterm birth and low neonatal birth weight, reinforcing the impact of thyroid health on pregnancy outcomes.

A study by Maduka et al. [12] observed significantly lower thyroid hormone levels in preeclamptic women compared to normotensive pregnant women, except for T4, which was higher. This suggests a potential link between poor T4 to T3 conversion and preeclampsia. Bozkurt et al. [13] found significant differences in thyroid hormone levels between preeclamptic and normotensive pregnant women, with lower FT3 and FT4 values in preeclampsia. Aryee et al. [14] reported subclinical hypothyroidism in pregnant women with preeclampsia and gestational hypertension, with significantly higher FT4 levels in these groups. These studies collectively emphasize the critical role of thyroid hormone monitoring in managing preeclampsia and its associated complications.

In our study, the pre-eclampsia/eclampsia group had significantly higher blood pressure, with mean SBP of 150.00 ± 2.89 mmHg and DBP of 101.00 ± 2.18 mmHg, compared to 120.04 ± 11.32 mmHg and 79.36 ± 7.75 mmHg in the normotensive group (P < 0.001). This indicates a clear distinction in blood pressure profiles between preeclamptic and normotensive pregnant women. Gui et al. [11] similarly found that severe and early onset

preeclampsia was associated with significantly higher blood pressure, reinforcing the critical need for monitoring blood pressure in pregnant women to prevent adverse outcomes. Additionally, Aryee et al. [14] reported significantly higher systolic and diastolic blood pressures in preeclamptic and gestational hypertension groups compared to normotensive pregnant women. This aligns with our findings and underscores the relationship between elevated blood pressure and preeclampsia. Bozkurt et al. [13] also observed higher blood pressure readings in preeclamptic women, highlighting the impact of hypertension on pregnancy complications. Medjedovic et al. [15] emphasized that thyroid function is more adversely affected in pregnancies complicated with preeclampsia than with gestational hypertension, advocating for routine checks of both thyroid function and blood pressure in such pregnancies.

Another study by Su et al. [16] aimed to investigate the association between hypothyroxinemia and the risk of preeclampsia–eclampsia and gestational hypertension. While the study focused on thyroid hormone levels, it found no significant differences in blood sugar levels between preeclamptic and normotensive groups, supporting our observation that RBS levels remain consistent regardless of preeclampsia status. Medjedovic et al. [15] also explored the influence of maternal thyroid function on pregnancy-related hypertensive disorders and found no significant impact on blood sugar levels, further reinforcing the lack of association between preeclampsia and RBS levels. These studies collectively indicate that, unlike blood pressure and thyroid function, blood sugar levels are not significantly altered in preeclamptic pregnancies.

The elevated TSH levels observed in our study may be due to increased thyroid-binding globulin induced by higher estrogen levels during pregnancy, leading to a compensatory increase in TSH. Additionally, the reduced peripheral conversion of T4 to T3, as seen in preeclampsia, could explain the higher T T3 levels. Misra et al. [10] also reported elevated TSH levels in preeclamptic women, suggesting that thyroid dysfunction may contribute to the pathophysiology of preeclampsia. The stress and inflammation associated with preeclampsia could lead to altered hypothalamic-pituitary-thyroid axis function, resulting in higher TSH levels. This dysregulation may serve as a protective mechanism to ensure sufficient thyroid hormone levels despite the increased demand during pregnancy. [17] Our study has several limitations that should be acknowledged. Firstly, the sample size was relatively small, which may limit the generalizability of the findings. The thyroid hormone levels were measured at a single point in time, which may not accurately reflect the dynamic changes occurring throughout pregnancy. We also did not account for potential confounding factors such as pre-existing thyroid conditions or other comorbidities that could influence thyroid function and pregnancy outcomes. Finally, the lack of thyroid antibody testing means that autoimmune thyroiditis, which can impact thyroid function, was not assessed.

Conclusion

In conclusion, our study highlights the significant impact of pre-eclampsia and eclampsia on pregnancy outcomes, with thyroid dysfunction, particularly elevated TSH and T3 levels, being more prevalent in the pre-eclampsia/eclampsia group. These findings suggest potential endocrine involvement in hypertensive disorders during pregnancy. Early screening and effective management of both hypertension and thyroid abnormalities are essential to improve maternal and neonatal outcomes.

Bibliography

1. American College of Obstetricians and Gynecologists. Gestational hypertension and preeclampsia: ACOG practice bulletin, number 222. Obstet Gynecol. 2020; 135(6):e237–60.
2. Auger N, Fraser WD, Healy-Profitós J, Arbour L. Association between preeclampsia and congenital heart defects. Jama. 2015; 314(15):1588–98.
3. Airao BB, Patel NN, Dholariya AB. Prevalence of thyroid disorders in antenatal patients and its feto-maternal outcome. Int J Reprod Contracept Obstet Gynecol. 2022; 11(2):427–33.
4. Alemu A, Terefe B, Abebe M, Biadgo B. Thyroid hormone dysfunction during pregnancy: A review. Int J Reprod Biomed. 2016; 14(11):677.
5. De Leo S, Pearce EN. Autoimmune thyroid disease during pregnancy. Lancet Diabetes Endocrinol. 2018; 6(7):575–86.
6. Anandappa S, Joshi M, Polanski L, Carroll PV. Thyroid disorders in subfertility and early pregnancy. Ther Adv Endocrinol Metab. 2020; 11:2042018820945855.
7. Burton GJ, Redman CW, Roberts JM, Moffett A. Pre-eclampsia: pathophysiology and clinical implications. Bmj. 2019; 366.
8. Chappell LC, Cluver CA, Tong S. Pre-eclampsia. The Lancet. 2021; 398(10297):341–54.
9. Garovic VD, Dechend R, Easterling T, Karumanchi SA, McMurtry Baird S, Magee LA, et al. Hypertension in pregnancy: diagnosis, blood pressure goals, and pharmacotherapy: a scientific statement from the American Heart Association. Hypertension. 2022; 79(2):e21–41.

10. Misra M, Singh L, Thakur A, Singh S, Kumar J, Juyal D. Comparative Analysis of Serum Calcium Level and Thyroid Profile in Pregnant Normotensive and Preeclamptic Women: A Case-Control Study. J Clin Diagn Res. 2020; 14(5).
11. Gui J, Xu W, Zhang J. Association between thyroid dysfunction and perinatal outcomes in women with gestational hypertension: a retrospective study. BMC Pregnancy Childbirth. 2020; 20(1):1–9.
12. Maduka I, Obi N, Egwu M. Evaluation of Thyroid Hormones and Thyroid Antibodies in Nigerian Pregnant Women with Pre-eclampsia. J Med Lab. 2020; 30(4):52–61.
13. Bozkurt ME, Yucel O, Saler T. An investigation into thyroid function tests in pregnant women and the relationship between thyroid autoantibodies and preeclampsia. 2020;
14. Aryee NA, Adu-Bonsaffoh K, Arko-Boham B, Quaye O, Asazu H, Tagoe E. Thyroid hormone profile in preeclampsia patients: a case control study. Gynecol Endocrinol. 2023; 39(1):2186136.
15. Medjedovic E, Stanojevic M, Kurjak A, Begic E, Iglica A, Jonuzovic-Prosic S. Association between maternal thyroid function and risk of gestational hypertension and preeclampsia. J Perinat Med. 2022; 50(7):904–9.
16. Su X, Liu Y, Li G, Liu X, Huang S, Duan T, et al. Associations of hypothyroxinemia with risk of preeclampsia–eclampsia and gestational hypertension. Front Endocrinol. 2021; 12:777152.
17. Anifantaki F, Pervanidou P, Lambrinoudaki I, Panoulis K, Vlahos N, Eleftheriades M. Maternal prenatal stress, thyroid function and neurodevelopment of the offspring: A mini review of the literature. Front Neurosci. 2021; 15:692446.