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Original Research Article

Association of subclinical thyroid disorder in hypertensive pregnant women attending a tertiary care hospital

Fahmida Sultana Mili[1]*, Sumona Yesmin[2], Iftekhar Ahmed[3], Hlakhing Sen Shoma[4], Najmatun Jikria[5], Jesmine Ara Haque[6], Tasrina Akter[7]

[1]Department of Obstetrics and Gynecology, Chittagong Medical College Hospital, Chittagong. Bangladesh
[2]250 Bed General Hospital, Munshigan, Bangladesh
[3]Department of Orthopaedic Surgery, Chittagong Medical College Hospital, Chittagong, Bangladesh
[4]Department of Obstetrics and Gynaecology, Dhaka Medical College Hospital, Dhaka, Bangladesh
[5]250 Beded Sadar Hospital, Naogaon, Bangladesh
[6]Institute of Nuclear Medicine and Allied Sciences, Dhaka, Bangladesh
[7]Department of Gynaecology and Obstetrics, Nottingham University Hospitals NHS Trust, City Campus Nottingham, United Kingdom

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***Correspondence:**
Fahmida Sultana Mili,
E-mail: sfahmida84.fsm@gmail.com

ABSTRACT

Background: Subclinical thyroid disorders have gained increasing attention because thyroid hormones play an important role in cardiovascular function and blood pressure regulation, and pregnancy-related physiological changes further complicate the assessment of thyroid function. The purpose of the present study was to evaluate the association between subclinical thyroid disorder and hypertension in pregnant women attending a tertiary care hospital.
Methods: This cross-sectional comparative study at the Department of Obstetrics and Gynaecology, Dhaka Medical College Hospital (DMCH), Dhaka, Bangladesh (Feb 2020–Mar 2021), included 220 pregnant women (110 hypertensive, 110 normotensive) matched for age, parity, and gestational age. Socio-demographic, obstetric, and clinical data were collected, blood pressure measured, and serum TSH and FT4 analyzed using Siemens ADVIA Centaur XP CLIA with ATA trimester-specific ranges. Data were analyzed with SPSS 25 ($p < 0.05$).
Results: Among 220 pregnant women (110 hypertensive, 110 normotensive), most were 18–25 years, 29–40 weeks gestation, and nulliparous, with no significant differences. Pre-eclampsia with severe features was most common (40%). Subclinical hypothyroidism was higher in hypertensive women (46.4% vs 14.5%, $p=0.001$) and associated with elevated BP. Hypertensive women had higher TSH (4.46 vs 2.28 µIU/ml) and lower FT4 (13.49 vs 15.78 pmol/l), most pronounced in pre-eclampsia ($p \leq 0.001$).
Conclusions: Subclinical hypothyroidism is the most common thyroid disorder in hypertensive pregnant women and is associated with higher blood pressure, suggesting early detection may help reduce the severity of pregnancy-related hypertension.

Keywords: Subclinical thyroid disorder, Hypertension in pregnancy, Thyroid dysfunction

INTRODUCTION

The study of subclinical thyroid disorder has attracted increasing interest in recent years. Its role in individuals with hypertension has intrigued researchers and clinicians, yet remains controversial. Thyroid hormone has well-recognized effects on the cardiovascular system and blood pressure regulation. Hyperthyroidism leads to increased

cardiac output, contractility, tachycardia, systolic pressures, widened pulse pressure, decreased systemic vascular resistance, and increased basal metabolic rate, whereas hypothyroidism manifests as decreased cardiac output, narrow pulse pressure, increased systemic vascular resistance, and reduced metabolic rate.[1] Pregnancy induces progressive anatomical, physiological, and biochemical changes affecting multiple systems, including the thyroid gland. The thyroid increases in size by 10% in iodine-replete countries and by 20–40% in iodine-deficient areas. Thyroid hormone production, including thyroxine (T4) and triiodothyronine (T3), increases by nearly 50%, with a corresponding 50% rise in daily iodine requirement. Placental human chorionic gonadotropin (HCG), especially its alpha subunit, stimulates thyroid activity. Elevated maternal estrogen also increases thyroxine-binding globulin (TBG), expanding the extra-thyroidal hormone pool and raising total T3 and T4 levels.[2,3] While these changes occur in healthy pregnancies, thyroid dysfunction may arise due to pathological processes, and accurate assessment of maternal thyroid function remains challenging, particularly because laboratory interpretation differs from that of non-pregnant women.[4]

Subclinical thyroid disease is defined as an abnormal serum thyrotropin (TSH) level with normal free thyroxine (FT4). Although generally associated with mild or nonspecific symptoms, abnormal TSH has been linked to increased cardiovascular risk. Its prevalence in the general population ranges from 3-12% for subclinical hypothyroidism and 1-6% for subclinical hyperthyroidism.[5] In India, about 13% of pregnancies are affected by hypothyroidism, and subclinical hypothyroidism occurs in approximately 2.3% of pregnant women.[6,7] Maternal thyroid dysfunction, including subclinical hypothyroidism and hyperthyroidism, may adversely affect pregnancy outcomes. Hypertension is a global health problem affecting 25-40% of individuals and is a major cardiovascular risk factor.

Among reproductive-aged women, the prevalence is estimated at 7.7%.[8] In pregnancy, hypertension is defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg based on two measurements taken at least 15 minutes apart.[9] Hypertensive disorders of pregnancy—including preexisting hypertension, gestational hypertension, preeclampsia, and eclampsia—complicate up to 10% of pregnancies and are a significant cause of maternal and perinatal morbidity and mortality.[10] Preeclampsia complicates 2-8% of pregnancies globally and remains an important cause of maternal mortality.[11] It contributes to 9-26% of maternal deaths in Africa, Asia, Latin America, and the Caribbean, and its prevalence in developing countries ranges from 1.8% to 16.7%.[12,13] In Bangladesh, although maternal mortality has decreased by 40% from 2001 to 2010, preeclampsia and eclampsia remain leading causes of maternal death.[14] The effects of longstanding subclinical thyroid disorders on blood pressure are less well studied and remain controversial. Some studies suggest an association between subclinical hypothyroidism and hypertension, while others do not. Subclinical hyperthyroidism has been less frequently studied. Population-based and case-control studies have reported higher systolic and diastolic blood pressures in women with elevated TSH.[15,16]

Treatment of subclinical hypothyroidism may reduce mean arterial pressure in some cases.[17] Serum TSH concentrations are higher and free thyroxine index lower in hypertensive subjects compared with normotensive subjects, suggesting either common genetic regulation of blood pressure and thyroid axis set points or hypertensive effects of mild subclinical hypothyroidism.[18,19] A population-based study also reported that small differences in serum TSH were associated with significant differences in diastolic blood pressure.[20] Women with subclinical hypothyroidism identified during pregnancy have an increased risk of severe preeclampsia compared with euthyroid women.[21]

Due to variability in definitions, cut-offs, gestational ages of testing, and small sample sizes, the association between subclinical thyroid disorders and pregnancy complications remains difficult to interpret. In Bangladesh, studies evaluating the frequency of subclinical thyroid disorder among hypertensive pregnant women are scarce. Therefore, the present study aimed to evaluate the association between subclinical thyroid disorder and hypertension in pregnant women. Understanding this relationship may help predict adverse obstetric outcomes and enable early preventive measures to reduce both maternal and fetal morbidity and mortality.

METHODS

This cross-sectional comparative study was conducted at the Department of Obstetrics and Gynaecology, Dhaka Medical College Hospital (DMCH), Dhaka, Bangladesh, from February 2020 to March 2021. A total of 220 pregnant women were enrolled, including 110 hypertensive and 110 normotensive women matched for age, parity, and gestational age. Participants were selected by purposive sampling according to predefined inclusion and exclusion criteria to assess the association of subclinical thyroid disorders with hypertensive disorders of pregnancy.

Inclusion criteria

Hypertensive pregnant women aged ≥18 years. Normotensive pregnant women aged ≥18 years, matched for age, parity, and gestational age.

Exclusion criteria

Known thyroid disorders. Medications affecting thyroid function (e.g., thyroxine, anti-thyroid drugs, glucocorticoids, antiepileptics, contraceptives). Diabetes treated with oral hypoglycaemic agents or insulin.

Data collection

Socio-demographic and clinical data—including age, residence, family history of hypertension, gestational age, parity, and BMI—were recorded using a structured questionnaire through face-to-face interviews. Blood pressure was measured twice, at least 15 minutes apart, with hypertension defined as systolic BP ≥140 mmHg and/or diastolic BP ≥90 mmHg. Hypertensive disorders were classified per SOGC 2014 guidelines into chronic hypertension, gestational hypertension, preeclampsia (with or without severe features), eclampsia, and superimposed preeclampsia.

Laboratory analysis

Venous blood samples (5 ml) were collected under aseptic conditions, centrifuged at 3000 rpm for 10 minutes, and serum stored at −20°C until analysis. Serum TSH and FT4 levels were measured using the Siemens ADVIA Centaur XP CLIA system. Subclinical thyroid disorders were defined according to trimester-specific reference ranges recommended by the American Thyroid Association.

Data analysis

Data were checked, coded, and analysed using SPSS version 25. Categorical variables were presented as frequency and percentage. Statistical significance was considered at p <0.05.

Ethical considerations

Ethical approval was obtained from the Ethical Review Committee of Dhaka Medical College. Written informed consent was obtained from all participants, confidentiality was maintained, and participants could withdraw at any time without affecting their care.

RESULTS

Table 1 shows the distribution of participants by age group. The highest frequency was observed in the 18–25 years age group in both hypertensive and normotensive women (51.8% vs 44.5%), followed by 26–30 years (25.5% vs 33.6%). No statistically significant difference was noted between groups (p=0.563).

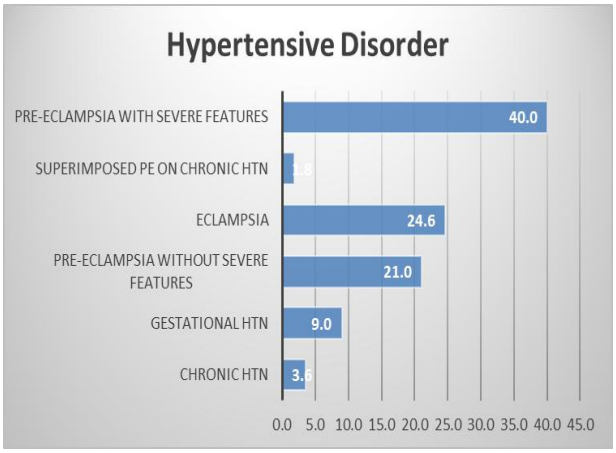

Figure 1: Frequency of types of hypertensive disorders (n = 110).

The mean age was 25.95 ± 5.83 years in hypertensive women and 26.24 ± 5.74 years in normotensive women (p=0.728). Table 2 presents gestational age distribution. Most participants were in the 29–40 weeks category (83.6% vs 78.2%). There was no significant difference between hypertensive and normotensive groups (p=0.458). Table 3 shows parity distribution. Nulliparous women predominated in both hypertensive and normotensive groups (85.5% vs 83.6%), while multiparous women accounted for 14.5% and 16.4%, respectively. The difference was not statistically significant (p=0.709). Figure 1 illustrates the frequency of different hypertensive disorders. Pre-eclampsia with severe features was most common (40%), followed by eclampsia (24.6%), pre-eclampsia without severe features (21%), gestational hypertension (9%), chronic hypertension (3.6%), and superimposed pre-eclampsia on chronic hypertension (1.8%).

Table 1: Distribution of study participants according to age group (n=220).

Age group (years)	Hypertensive group frequency (N)	Percentage (%)	Normotensive group frequency (N)	Percentage (%)	P value
18–25	57	51.8	49	44.5	0.563
26–30	28	25.5	37	33.6	
31–35	20	18.2	18	16.4	
36–40	5	4.5	6	5.5	
Total	110	100.0	110	100.0	
Mean±SD	25.95±5.827		26.24±5.736		0.728

Table 4 compares thyroid status between hypertensive and normotensive women. Subclinical hypothyroidism was most common in hypertensive women (46.4%), whereas euthyroidism predominated in normotensive women (83.6%). Hypothyroidism was present in 13.6% of hypertensive women and 0.9% of normotensive women. Subclinical hyperthyroidism was rare in both groups (1% vs 0.9%). Differences were statistically significant (p=0.001).

Table 2: Distribution of study participants according to gestational age (n=220).

Gestational age (weeks)	Hypertensive group frequency (N)	Percentage (%)	Normotensive group frequency (N)	Percentage (%)	P value
12–28	7	6.4	12	10.9	0.458
29–40	92	83.6	86	78.2	
>40	11	10.0	12	10.9	
Total	110	100.0	110	100.0	

Table 3: Distribution of study participants according to parity (n=220).

Parity	Hypertensive group frequency (N)	Percentage (%)	Normotensive group frequency (N)	Percentage (%)	P value
Nulliparous	94	85.5	92	83.6	0.709
Multiparous	16	14.5	18	16.4	
Total	110	100.0	110	100.0	

Table 4: Thyroid status among hypertensive and normotensive participants (n=220).

Thyroid status	Hypertensive group frequency (N)	Percentage (%)	Normotensive group frequency (N)	Percentage (%)	P value
Euthyroid	43	39.1	92	83.6	0.001
Hypothyroid	15	13.6	1	0.9	
Subclinical hypothyroidism	51	46.4	16	14.5	
Subclinical hyperthyroidism	1	1.0	1	0.9	
Total	110	100.0	110	100.0	

Table 5: Relationship of clinico-demographic variables with thyroid status (n=220).

Variable		Hypertensive group (n=110)			P value	Normotensive group (n=110)			P value
		Euthyroid	Subclinical hypo	Other		Euthyroid	Subclinical hypo	Other	
Age group (years)	18–25	21	29	7	0.661	42	5	2	0.623
	26–30	12	9	7		28	9	0	
	31–35	8	10	2		16	2	0	
	36–40	2	3	0		6	0	0	
Residence	Urban	42	50	15	0.81	90	15	2	0.823
	Rural	2	1	1		2	1	0	
Gestational age (weeks)	12–28	3	3	1	0.997	10	1	1	0.184
	29–40	35	43	14		72	13	1	
	>40	5	5	1		10	2	0	
Parity	Nulliparous	34	47	13	0.286	76	14	2	0.888
	Multiparous	9	4	3		16	2	0	
Family history HTN	Present	18	17	7	0.186	28	4	1	0.458
	Unknown	6	12	6		19	2	0	
	Absent	19	22	3		45	10	1	
BMI	18.5–24.9	28	30	8	0.419	50	10	1	0.858
	25–29.9	15	20	7		41	6	1	

Table 5 shows thyroid status in relation to age, residence, gestational age, parity, family history of hypertension, and BMI. In hypertensive women, subclinical hypothyroidism was most frequent in the 18–25 years age group (29 women), urban residents (50 women), and nulliparous women (47 women). In normotensive women, euthyroidism predominated across all variables. No statistically significant associations were found within either group (p>0.05).

Table 6 presents thyroid disorders across blood pressure categories. Subclinical hypothyroidism and hypothyroidism were more common in women with elevated blood pressure (>140/90 mmHg). The association between thyroid status and blood pressure was statistically significant (p=0.001). Table 7 shows mean serum TSH and FT4 levels. Hypertensive women had higher TSH (4.46±3.38 µIU/ml) and lower FT4 (13.49±2.86 pmol/l) compared to normotensive women (TSH 2.28±1.31 µIU/ml, FT4 15.78±2.86 pmol/l). Differences were statistically significant (p=0.001). Table 8 compares thyroid function across hypertensive disorders. Pre-eclampsia (with and without severe features) and gestational hypertension were associated with higher TSH and lower FT4 levels. These differences were statistically significant (p=0.0001).

Table 6: Thyroid status according to blood pressure categories (n=220).

Blood pressure	Euthyroid	Hypothyroid	Subclinical hypothyroidism	Subclinical hyperthyroidism	P value
<140/90 (normal BP)	92	1	16	1	0.001
>140/90 – <160/110 (HTN)	23	8	26	1	
>160/110 (severe HTN)	20	7	25	0	
Total	135	16	67	2	

Table 7: Serum TSH and FT4 levels in hypertensive and normotensive participants (n=220).

Thyroid Function Test	Hypertensive Group (n=110) Mean ± SD	Range (min–max)	Normotensive Group (n=110) Mean ± SD	Range (min–max)	P value
S. TSH (µIU/ml)	4.46±3.38	0.25–22.81	2.28±1.31	0.1–7.14	0.001
FT4 (pmol/l)	13.49±2.86	6.23–23.19	15.78±2.86	8.5–23.94	0.001

Table 8: Serum TSH and FT4 levels across different types of hypertensive disorders (n=110).

Thyroid test	Chronic HTN	Gestational HTN	Pre-eclampsia	PE with severe features	Eclampsia	Superimposed PE on chronic HTN	P value
TSH (µIU/ml)	2.28±1.31	4.62±3.18	5.59±3.51	4.54±3.93	3.76±2.31	1.28±0.45	0.0001
FT4 (pmol/l)	14.36±2.78	12.34±2.45	12.87±2.05	13.50±2.97	14.25±3.09	13.74±7.41	0.0001

DISCUSSION

This cross-sectional study was conducted to assess the frequency of subclinical thyroid disorders in hypertensive pregnant women according to the reference range defined by ATA guidelines. Subjects were recruited from the Department of Obstetrics and Gynecology of Dhaka Medical College Hospital after fulfilling the inclusion and exclusion criteria. The findings of the present study are discussed in comparison with previously published relevant studies. A total of 220 subjects were included, comprising 110 (50%) cases with hypertensive disorders and 110 (50%) age-, parity-, and gestational age-matched normotensive pregnant women.

In the present study, the highest frequency was observed in the 18–25 years age group in both hypertensive and normotensive women (51.8% vs 44.5%), followed by the 26–30 years age group (25.5% vs 33.6%). This difference was not statistically significant (p=0.563). The mean age was 25.95±5.83 years in hypertensive women (range 18–40 years) and 26.24±5.74 years in normotensive women, with no statistically significant difference (p>0.05). Thus, both groups were matched for age. Ashok et al reported a mean age of 28.4±6.24 years in the study group and 27.5±5.91 years in the control group, with no significant difference (p>0.05).[22] Similarly, Hosen et al found mean ages of 25.04±0.1 years in the preeclamptic group and 26±0.1 years in the control group, with no significant difference.[23]

Most participants in both groups were in the 29-40 weeks gestational age category (92 vs 86), with no statistically significant difference (p=0.458), indicating that the groups were matched for gestational age. Basbug et al reported mean gestational ages of 35.4± 0.97 weeks in preeclamptic women and 38.3±2.57 weeks in controls.[24] Ashok et al reported 34.3±2.92 weeks in the study group and 35.1±2.86 weeks in the control group.[22] In contrast, Hosen et al observed a significant difference between the case (34.11±0.5 weeks) and control (38.36±0.7 weeks) groups.[23] Regarding parity, the majority of women in both groups were nulliparous. In the hypertensive group, 85.5% were nulliparous and 14.5% multiparous; in the normotensive group, 83.6% were nulliparous and 16.4%

multiparous, with no statistically significant difference (p>0.05). Basbug et al also reported no significant difference between case (65% nulliparous) and control (70% nulliparous) groups.[24]

In the hypertensive group, thyroid status varied by age. Among women aged 18–25 years, 29 out of 57 had subclinical hypothyroidism and 21 had euthyroidism. In the 26–30 years group, 12 had euthyroidism and 9 had hypothyroidism. These differences were not statistically significant (p=0.661). In normotensive women aged 18–25 years, 42 out of 49 were euthyroid and 5 had subclinical hypothyroidism. In the 26–30 years group, 28 were euthyroid and 9 had subclinical hypothyroidism (p=0.623). Most hypertensive women (107 out of 110) resided in urban areas, but residence did not significantly affect thyroid status (p=0.81). Similarly, in the normotensive group, 107 out of 110 were urban residents, with no significant impact on thyroid status (p=0.823).

Gestational age did not affect thyroid status. Among hypertensive women in the 29–40 weeks category, 43 (47.8%) had subclinical hypothyroidism and 35 (38.9%) were euthyroid (p=0.997). In normotensive women, 72 (83.7%) were euthyroid and 13 (15.1%) had subclinical hypothyroidism (p=0.184). Parity also had no significant impact on thyroid status. In hypertensive nulliparous women (n=94), 47 (50%) had subclinical hypothyroidism, while 25% of multiparous women had subclinical hypothyroidism (p=0.286). In the normotensive group, 76 nulliparous women (69.1%) were euthyroid and 14 (12.7%) had subclinical hypothyroidism; among multiparous women, 88.9% were euthyroid and 11.1% had subclinical hypothyroidism (p=0.888).

Among women with a family history of hypertension, 18 had euthyroidism and 17 had subclinical hypothyroidism (p=0.186). Regarding BMI, most participants had BMI between 18.5–29.9 kg/m². In hypertensive women with normal BMI (18.5–24.9 kg/m²), 30 had subclinical hypothyroidism and 7 had overt hypothyroidism; in the overweight group (25–29.9 kg/m²), 20 had subclinical hypothyroidism and 7 had overt hypothyroidism (p=0.419). In normotensive women with normal BMI, 50 were euthyroid and 10 had subclinical hypothyroidism, whereas in the overweight group, 41 were euthyroid and 6 had subclinical hypothyroidism (p=0.419).

Among hypertensive patients, the distribution of hypertensive disorders was as follows: preeclampsia with severe features (40%), eclampsia (24%), preeclampsia without severe features (21%), gestational hypertension (9%), chronic hypertension (4%), and chronic hypertension with superimposed preeclampsia (2%). Thyroid dysfunction during pregnancy has a prevalence of 2-5%.[5] In this study, 46% of hypertensive women had subclinical hypothyroidism, 39% were euthyroid, 13.6% had overt hypothyroidism, and 1% had hyperthyroidism. Among normotensive women, 83.6% were euthyroid and 14.5% had subclinical hypothyroidism. The difference in thyroid status between the two groups was statistically significant (p=0.001). Chunchaiah et al reported a prevalence of hypothyroidism of 10.12%, mostly subclinical (7.37%), with hyperthyroidism being less common.[7] In Bangladesh, Akter et al found subclinical hypothyroidism in 21.5% of pregnant women, whereas Khan et al reported 41% subclinical hypothyroidism.[25,26]

In the hypertensive group, the mean TSH was 4.46±3.38 µIU/ml and mean FT4 was 13.49±2.86 pmol/l. In normotensive women, TSH was 2.28±1.31 µIU/ml and FT4 was 15.78±2.86 pmol/l. TSH was significantly higher (p=0.001) and FT4 significantly lower (p=0.001) in hypertensive women, although FT4 remained within the reference range. These findings align with reports that demonstrated higher TSH levels in preeclamptic women.[22,23,27-31] Khadem et al found no significant differences in TSH and FT4 values.[32]

Across hypertensive disorders, mean TSH values were highest in preeclampsia (5.59±3.51 µIU/ml) and gestational hypertension (4.62±3.18 µIU/ml), and lowest in chronic hypertension with superimposed preeclampsia (1.28±0.45 µIU/ml) (p=0.0001). Mean FT4 was lowest in preeclampsia (12.87±2.05 pmol/l) and gestational hypertension (12.34±2.45 pmol/l) and highest in chronic hypertension (14.36±2.78 pmol/l) (p=0.0001). Normotensive women with BP <140/90 mmHg were mostly euthyroid (n=92). Among hypertensive women with BP >140/90 mmHg, 26 of 58 (44.8%) had subclinical hypothyroidism, and in those with BP >160/110 mmHg, 25 of 52 (48.1%) had subclinical hypothyroidism. This association was statistically significant (p=0.001), indicating that higher blood pressure is associated with subclinical hypothyroidism.[21-29] Overall, both our study and prior studies indicate that subclinical thyroid disorders are more common in hypertensive pregnant women than in normotensive controls.

Limitations

The study was cross-sectional and not longitudinal, lacking baseline thyroid function data from the pre-pregnancy period and first trimester before the development of hypertensive disorders, as well as follow-up data after delivery. This limits the ability to establish a causal relationship between subclinical thyroid disorder and hypertensive disorders of pregnancy. A complete evaluation of thyroid function in pregnancy requires assessment of anti-thyroid antibodies, which was not performed in this study. The study population was recruited from a single hospital in Dhaka city; therefore, the results may not be representative of the entire country.

CONCLUSION

The results of the study showed that serum TSH levels are significantly higher in hypertensive pregnant women compared to normotensive pregnant women, with the highest mean TSH observed in patients with preeclampsia.

It was also found that elevated systolic and diastolic blood pressures were associated with subclinical hypothyroidism. Therefore, there is a clear association between subclinical thyroid disorders and hypertension in pregnancy, with subclinical hypothyroidism being the most common type among hypertensive pregnant women. Early identification and appropriate management of subclinical thyroid disorders may help predict and reduce the severity of hypertensive disorders during pregnancy.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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