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Maternal and Neonatal Outcomes Among Pregnant Women With Hypothyroidism

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Abstract

Introduction: Hypothyroidism is an important endocrine disorder during pregnancy. The present study aimed to assess the prevalence of hypothyroidism and assess fetomaternal outcomes among pregnant women.

Materials and methods: A prospective observational study was conducted among 300 antenatal women at Adichunchanagiri Hospital and Research Centre, Karnataka, India, from July 2024 to December 2025. Participants underwent clinical assessment and laboratory evaluation of thyroid-stimulating hormone, free thyroxine, and triiodothyronine. Thyroid dysfunction was classified using trimester-specific reference ranges. Maternal and neonatal outcomes were assessed prospectively until delivery and discharge. Data were analyzed using IBM SPSS Statistics for Windows, Version 26 (Released 2016; IBM Corp., Armonk, New York, United States).

Results: Among 300 participants, 208 (69.33%) were euthyroid, 65 (21.67%) had subclinical hypothyroidism, and 27 (9.00%) had overt hypothyroidism. Preterm delivery occurred in 22 (81.48%) women with overt hypothyroidism compared with 0 (0.00%) in the euthyroid and subclinical groups ($p < 0.0001$). Lower-segment cesarean section (LSCS) was performed in 34 (16.35%), 27 (41.54%), and 12 (44.44%) women, respectively ($p < 0.0001$). Low birth weight occurred in 42 (20.19%), 28 (43.08%), and 27 (100.00%) neonates, while neonatal intensive care unit (NICU) admission occurred in four (1.92%), 22 (33.85%), and nine (33.33%), respectively ($p < 0.0001$). Mean neonatal thyroid-stimulating hormone (TSH) increased from 8.51 ± 3.40 mIU/L in the euthyroid group to 10.97 ± 3.59 mIU/L in the overt hypothyroidism group ($p < 0.001$).

Conclusion: Maternal thyroid dysfunction, particularly overt hypothyroidism, was associated with adverse fetomaternal and neonatal outcomes. Early identification of thyroid dysfunction, appropriate management, and regular antenatal and neonatal monitoring are important for optimizing maternal and neonatal outcomes.

Categories: Obstetrics/Gynecology
Keywords: fetomaternal outcome, hypothyroidism, neonatal outcome, pregnancy, thyroid dysfunction

Introduction

Pregnancy is associated with profound endocrine and metabolic adaptations that support maternal health and fetal growth [1]. The thyroid gland plays a critical role during pregnancy, particularly in early gestation, when the developing fetus depends largely on maternal thyroid hormones for growth and neurodevelopment [2]. Hypothyroidism is an important endocrine disorder during pregnancy and may remain clinically unrecognized because its symptoms, including fatigue, lethargy, weight gain, constipation, and cold intolerance, overlap with normal pregnancy-related changes [3]. It may present as overt hypothyroidism, characterized by elevated thyroid-stimulating hormone (TSH) with reduced free thyroxine (FT4), or subclinical hypothyroidism, characterized by elevated TSH with normal FT4 levels [4].

The burden of hypothyroidism during pregnancy is particularly relevant in India, where hospital- and population-based studies have documented a substantial occurrence of thyroid dysfunction among pregnant women, with subclinical hypothyroidism accounting for a considerable proportion of cases [5-7]. The reported prevalence varies across different regions and study populations, highlighting the need for greater awareness, timely diagnosis, and appropriate management of thyroid dysfunction during pregnancy [8-10]. Factors contributing to the increased burden include iodine deficiency, autoimmune thyroid disease, nutritional inadequacies, limited awareness, and inconsistent antenatal screening [11]. Furthermore, the increased physiological demand for thyroid hormones during pregnancy may predispose women with limited thyroid reserve to thyroid dysfunction [12].

Maternal hypothyroidism has been associated with several adverse fetomaternal outcomes. Impaired placentation, endothelial dysfunction, and altered uteroplacental blood flow may contribute to hypertensive disorders and placental insufficiency [13]. Maternal complications reported in association with

hypothyroidism include anemia, gestational hypertension, preeclampsia, placental abruption, postpartum haemorrhage, and increased operative delivery [14]. Fetal and neonatal complications, including preterm birth, low birth weight, impaired neonatal adaptation, and admission to the neonatal intensive care unit (NICU), have also been reported in association with maternal thyroid dysfunction, particularly in overt or inadequately controlled disease [15].

Despite the recognized maternal and fetal consequences of hypothyroidism, screening and the use of pregnancy-specific thyroid reference ranges remain inconsistent, particularly in resource-limited settings. Moreover, differences in diagnostic criteria, trimester-specific reference ranges, and study populations contribute to variation in the reported prevalence and clinical outcomes of thyroid dysfunction during pregnancy. Region-specific data are therefore important for understanding the burden of disease and its associated outcomes. The present study aimed to assess the prevalence of thyroid dysfunction, including subclinical and overt hypothyroidism, among pregnant women and to evaluate its association with maternal and neonatal outcomes.

Materials And Methods

Study design and setting

This prospective observational study was conducted in the Department of Obstetrics and Gynaecology, Adichunchanagiri Hospital and Research Centre, Adichunchanagiri University, B.G. Nagara, Nagamangala Taluk, Mandya District, Karnataka, India, from July 2024 to December 2025. Ethical approval was obtained from the Institutional Ethics Committee (IEC No. AIMS/IEC/079/2024). Written informed consent was obtained from all participants before enrolment in the study.

Study population

Antenatal women attending the outpatient department or admitted to the antenatal wards during the study period were considered for inclusion. Participants were enrolled during the antenatal period, predominantly between eight and 36 weeks of gestation. Women with multifetal gestation, pre-existing diabetes mellitus, hypertension, liver or renal disorders, known thyroid disorders predating the current pregnancy, previous adverse obstetric history with a known cause, or those unwilling to participate were excluded. Women with hyperthyroidism or other overt thyroid disorders apart from hypothyroidism were not included in the study. All 300 enrolled participants were followed prospectively until delivery, and there were no losses to follow-up during the study period.

Sample size

The sample size was calculated using the formula: $n = \frac{Z^2 pq}{d^2}$, where n is the required sample size, Z is the standard normal deviate at a 95% confidence level (1.96), p is the expected prevalence of thyroid dysfunction (21.1%), q = 100-p, and d is the allowable absolute error (4.8%). The prevalence of 21.1% was adopted from the study by Kumari et al. [10]. The minimum required sample size was approximately 277. To ensure adequate enrolment, a total of 300 participants were included in the present study.

Data collection and thyroid assessment

Following Institutional Ethics Committee approval, demographic details, obstetric history, and relevant clinical findings were recorded through direct interview and clinical examination. All participants underwent general physical, systemic, and obstetric examinations. Gestational age was assessed based on the last menstrual period and/or ultrasonography. Venous blood samples were collected for estimation of serum TSH, FT4, free triiodothyronine (FT3), and complete blood count. Anemia was defined as a hemoglobin concentration <11 g/dL during pregnancy, in accordance with the World Health Organization criterion. Thyroid status was classified using trimester-specific reference ranges for TSH, FT4, and FT3. The reference ranges reported for Indian pregnant women were used for interpretation [16,17]. The trimester-specific reference ranges are presented in Table *1*.

Parameter	First Trimester	Second Trimester	Third Trimester
TSH (μIU/mL)	0.19-4.34	0.46-4.57	0.61-4.62
FT4 (ng/dL)	0.88-1.32	0.89-1.60	0.87-1.54
FT3 (pmol/L)	1.92-5.86	3.20-5.73	3.30-5.18

TABLE 1: Trimester-Specific Reference Ranges for Thyroid Profile

TSH: thyroid-stimulating hormone; FT4: free thyroxine; FT3: free triiodothyronine

Euthyroidism was defined as TSH and FT4 values within the corresponding trimester-specific reference ranges. Subclinical hypothyroidism was defined as a TSH concentration above the trimester-specific upper reference limit with FT4 within the corresponding trimester-specific reference range. Overt hypothyroidism was defined as an elevated TSH concentration with FT4 below the corresponding trimester-specific reference range. TSH receptor antibodies (TRAb) and thyroid-stimulating antibodies (TSAb) were not routinely measured in the present study. Thyroid status was classified based on serum TSH, FT4, and FT3 concentrations. Thyroid peroxidase antibody testing was also not routinely performed.

Management of thyroid dysfunction

Women diagnosed with thyroid dysfunction during the study were referred for appropriate clinical management and were not intentionally left untreated. Levothyroxine was used as the thyroid hormone replacement therapy for hypothyroidism. Treatment was initiated according to the biochemical severity of thyroid dysfunction, gestational age, and clinical assessment. As a reference treatment protocol, women with subclinical hypothyroidism were generally initiated on levothyroxine at a low dose, commonly 25-50 μg once daily, whereas women with overt hypothyroidism generally required a higher initial dose, commonly 50-100 μg once daily, depending on the degree of biochemical abnormality and clinical assessment. Subsequent dose adjustments were made according to serial TSH measurements. Thyroid function was reassessed approximately every four to six weeks during pregnancy, and the levothyroxine dose was increased or decreased when clinically indicated. The classification of women into euthyroid, subclinical hypothyroidism, and overt hypothyroidism was based on their thyroid-function status at the time of initial assessment and did not imply that women with hypothyroidism remained untreated throughout pregnancy. Participants diagnosed with thyroid dysfunction were treated after diagnosis and subsequently followed during pregnancy.

Management of subclinical hypothyroidism in pregnancy

Treatment decisions for subclinical hypothyroidism were based on the degree of TSH elevation, FT4 concentration, gestational age, clinical status, and available antibody status. Levothyroxine is the preferred treatment for hypothyroidism during pregnancy. Current American Thyroid Association recommendations support treatment of overt hypothyroidism and recommend consideration of levothyroxine treatment for subclinical hypothyroidism according to TSH concentration and thyroid peroxidase antibody status. Maternal TSH should be monitored regularly during pregnancy and treatment adjusted accordingly. In the present study, treatment decisions were made by the treating clinician, and the study did not use a separate experimental treatment protocol.

Follow-up and assessment of outcomes

Participants were followed prospectively throughout pregnancy until delivery. Early pregnancy complications, including miscarriage, were assessed as part of the obstetric follow-up. No miscarriage occurred among the enrolled participants during the follow-up period. Maternal outcomes assessed included hypertensive disorders of pregnancy, preterm labour, mode of delivery, and other relevant obstetric complications. Fetal and neonatal outcomes included gestational age at delivery, birth weight, stillbirth, respiratory distress, NICU admission, and APGAR scores at 1 and 5 minutes after birth [18]. Neonatal TSH was measured after birth as part of neonatal thyroid assessment, with blood sampling performed within the early neonatal period. Following delivery, mothers and neonates were assessed until recovery or hospital discharge.

Statistical analysis

Data were entered, coded, and analysed using IBM SPSS Statistics for Windows, Version 26 (Released 2016; IBM Corp., Armonk, New York, United States). Quantitative variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Differences in quantitative variables across the three maternal thyroid-status groups were assessed using one-way analysis of variance (ANOVA). Categorical variables were compared using the chi-square test. A two-sided p-value

<0.05 was considered statistically significant.

Results

The study included 300 participants. The majority of women were aged 20-25 years (156, 52.00%) and had a normal body mass index (BMI) (170, 56.67%). Multigravida women constituted 243 (81.00%) of the study population. Based on maternal thyroid status, 208 (69.33%) women were euthyroid, 65 (21.67%) had subclinical hypothyroidism, and 27 (9.00%) had overt hypothyroidism. The distribution of participants according to baseline characteristics and maternal thyroid status is presented in Table 2.

Variable	Category	N (%)
Age (years)	20-25	156 (52.00)
	26-30	103 (34.33)
	31-35	33 (11.00)
	36-40	8 (2.67)
BMI (kg/m^2)	<18.5	7 (2.33)
	18.5-24.9	170 (56.67)
	25.0-29.9	105 (35.00)
	≥30.0	18 (6.00)
Gravidity	Primigravida	57 (19.00)
	Multigravida	243 (81.00)
Thyroid status	Euthyroid	208 (69.33)
	Subclinical hypothyroidism	65 (21.67)
	Overt hypothyroidism	27 (9.00)

TABLE 2: Baseline Characteristics and Thyroid Status of Study Participants

Data are presented as N (%).

BMI: body mass index

Hypertensive disorders of pregnancy were the most common maternal complication, occurring in 20 (6.67%) women, followed by gestational diabetes mellitus in nine (3.00%) women. Anemia and fetal growth restriction (FGR) were each observed in six (2.00%) women. The distribution of maternal complications in the overall study population is shown in Table 3.

Maternal Complication	N (%)
Hypertensive disorders of pregnancy	20 (6.67)
Gestational diabetes mellitus	9 (3.00)
Anemia	6 (2.00)
Fetal growth restriction	6 (2.00)

TABLE 3: Maternal Complications

Data are presented as N (%).

Preterm delivery, defined in the present study as delivery between 28 and <37 weeks, occurred in 22 (81.48%) women with overt hypothyroidism, whereas no preterm deliveries were recorded among women

with euthyroid status or subclinical hypothyroidism. Among the 22 preterm deliveries, 12 (54.55%) were medically indicated, and 10 (45.45%) were spontaneous preterm deliveries. Among the medically indicated preterm deliveries, severe preeclampsia was the most common indication (5, 22.73%), followed by FGR (3, 13.64%), non-reassuring fetal status (2, 9.09%), and other obstetric indications (2, 9.09%). Among spontaneous preterm deliveries, spontaneous preterm labour occurred in six (27.27%) and preterm premature rupture of membranes in four (18.18%). Among euthyroid women, 190 (91.35%) delivered between 37 and 40 weeks and 18 (8.65%) delivered after 40 weeks. All women with subclinical hypothyroidism delivered between 37 and 40 weeks. Normal vaginal delivery occurred in 173 (83.17%) euthyroid women, 38 (58.46%) women with subclinical hypothyroidism, and 14 (51.85%) women with overt hypothyroidism. The distribution of gestational age at delivery and mode of delivery differed significantly among the three maternal thyroid-status groups ($\chi^2 = 246.73$, df = 4, $p < 0.0001$ and $\chi^2 = 28.28$, df = 4, $p < 0.0001$, respectively). The findings are presented in Table 4.

Variable	Category	Euthyroid	Subclinical Hypothyroidism	Overt Hypothyroidism	χ^2 (df)	p-value
Gestational age at delivery	28-37 weeks	0 (0.00%)	0 (0.00%)	22 (81.48%)	246.73 (4)	<0.0001
	37-40 weeks	190 (91.35%)	65 (100.00%)	5 (18.52%)		
	>40 weeks	18 (8.65%)	0 (0.00%)	0 (0.00%)		
Mode of delivery	Normal vaginal delivery	173 (83.17%)	38 (58.46%)	14 (51.85%)	28.28 (4)	<0.0001
	LSCS	34 (16.35%)	27 (41.54%)	12 (44.44%)		
	Assisted vaginal delivery	1 (0.48%)	0 (0.00%)	1 (3.70%)		

TABLE 4: Gestational Age and Mode of Delivery According to Maternal Thyroid Status

Data are presented as N (%). A chi-square (χ^2) test was performed. A p-value <0.05 was considered statistically significant.

LSCS: lower-segment cesarean section; df: degrees of freedom

Among lower-segment cesarean section (LSCS) deliveries, previous LSCS was the most frequent indication among women with overt hypothyroidism, accounting for six (46.15%), whereas severe pre-eclampsia and previous LSCS were each reported in eight (29.63%) women with subclinical hypothyroidism. The distribution of indications for LSCS did not differ significantly according to maternal thyroid status ($\chi^2 = 4.19$, df = 8, $p = 0.840$) (Table 5).

Indication	Euthyroid	Subclinical Hypothyroidism	Overt Hypothyroidism	χ^2 (df)	p-value
Severe pre-eclampsia	10 (28.57%)	8 (29.63%)	2 (15.38%)	4.19 (8)	0.840
Previous LSCS	10 (28.57%)	8 (29.63%)	6 (46.15%)		
Cephalopelvic disproportion	8 (22.86%)	7 (25.93%)	2 (15.38%)		
Non-reassuring fetal heart rate	6 (17.14%)	4 (14.81%)	2 (15.38%)		
Poor maternal efforts with non-reassuring fetal heart rate	1 (2.86%)	0 (0.00%)	1 (7.69%)		

TABLE 5: Indications for LSCS According to Maternal Thyroid Status

Data are presented as N (%). A chi-square (χ^2) test was performed. A p-value <0.05 was considered statistically significant.

LSCS: lower-segment cesarean section; df: degrees of freedom

Regarding neonatal outcomes, meconium-stained amniotic fluid was observed in 25 (38.46%) women with subclinical hypothyroidism, compared with seven (3.37%) euthyroid women and one (3.70%) woman with overt hypothyroidism. Immediate cry after birth was documented in 205 (98.56%), 59 (90.77%), and 20 (74.07%) neonates in the euthyroid, subclinical hypothyroidism, and overt hypothyroidism groups, respectively. Low birth weight (<2.5 kg) occurred in 42 (20.19%), 28 (43.08%), and 27 (100.00%) neonates, respectively. APGAR scores of 4-6 at 1 minute were recorded in two (0.96%), four (6.15%), and five (18.52%) neonates, respectively. NICU admission occurred in four (1.92%), 22 (33.85%), and nine (33.33%) neonates, respectively. The distributions of meconium-stained amniotic fluid, immediate cry after birth, birth weight, APGAR score at 1 minute, and NICU admission differed significantly among the maternal thyroid-status groups (all $p < 0.0001$). In contrast, the indications for NICU admission did not differ significantly among the groups ($\chi^2 = 3.13$, df = 6, $p = 0.792$). The neonatal outcomes are presented in Table *6*.

Variable	Category	Euthyroid	Subclinical Hypothyroidism	Overt Hypothyroidism	χ^2 (df)	p-value
Amniotic fluid	Meconium-stained	7 (3.37%)	25 (38.46%)	1 (3.70%)	63.92 (2)	<0.0001
Immediate cry after birth	Yes	205 (98.56%)	59 (90.77%)	20 (74.07%)	30.87 (2)	<0.0001
Birth weight (kg)	<2.5	42 (20.19%)	28 (43.08%)	27 (100.00%)	74.56 (4)	<0.0001
	2.5-3.5	163 (78.37%)	37 (56.92%)	0 (0.00%)		
	>3.5	3 (1.44%)	0 (0.00%)	0 (0.00%)		
APGAR at 1 minute	4-6	2 (0.96%)	4 (6.15%)	5 (18.52%)	22.31 (2)	<0.0001
	7-10	206 (99.04%)	61 (93.85%)	22 (81.48%)		
APGAR at 5 minutes	7-10	208 (100.00%)	65 (100.00%)	27 (100.00%)	-	-
NICU admission	Yes	4 (1.92%)	22 (33.85%)	9 (33.33%)	62.49 (2)	<0.0001
Indication for NICU admission	Birth asphyxia	2 (50.00%)	5 (22.73%)	3 (33.33%)	3.13 (6)	0.792
	Prematurity	1 (25.00%)	5 (22.73%)	3 (33.33%)		
	Respiratory distress	1 (25.00%)	5 (22.73%)	1 (11.11%)		
	Low birth weight	0 (0.00%)	7 (31.82%)	2 (22.22%)		

TABLE 6: Neonatal Outcome According to Maternal Thyroid Status

Data are presented as N (%). The chi-square (χ^2) test was applied to compare categorical neonatal outcomes across the three maternal thyroid-status groups. The APGAR score was assessed as a standardized measure of neonatal condition at birth [18]. A p-value <0.05 was considered statistically significant.

APGAR: Appearance, Pulse, Grimace, Activity, and Respiration; NICU: neonatal intensive care unit; χ^2: Chi-square; df: degrees of freedom

Mean neonatal TSH levels were 8.51 ± 3.40 mIU/L in the euthyroid group, 9.71 ± 3.36 mIU/L in the subclinical hypothyroidism group, and 10.97 ± 3.59 mIU/L in the overt hypothyroidism group. The overall difference in mean neonatal TSH among the three groups was statistically significant on one-way ANOVA (F = 8.07, p < 0.001) (Table 7).

Outcome	Euthyroid	Subclinical Hypothyroidism	Overt Hypothyroidism	ANOVA	p-value
Neonatal TSH (mIU/L)	8.51 ± 3.40	9.71 ± 3.36	10.97 ± 3.59	8.07	<0.001

TABLE 7: Comparison of Neonatal TSH Levels According to Maternal Thyroid Status

Data are presented as mean ± standard deviation. One-way ANOVA was applied to compare mean neonatal TSH levels among the three maternal thyroid-status groups. A p-value <0.05 was considered statistically significant.

TSH: thyroid-stimulating hormone; ANOVA: analysis of variance

Discussion

In the present study, thyroid dysfunction was identified in a substantial proportion of antenatal women, with subclinical hypothyroidism observed in 65 (21.67%) and overt hypothyroidism in 27 (9.00%). The predominance of subclinical disease is consistent with previous Indian studies. Dhanwal et al. reported a high prevalence of hypothyroidism among pregnant women across multiple Indian cities, with subclinical disease accounting for a major proportion of cases [19]. Similarly, Ajmani et al. reported both overt and

subclinical thyroid dysfunction among Indian pregnant women [20]. The relatively high prevalence observed in the present study may be attributable to differences in the characteristics of the study population, screening practices, trimester-specific reference ranges, and diagnostic criteria used across studies.

A marked difference in gestational age at delivery was observed across the maternal thyroid-status groups, with preterm delivery occurring in 22 (81.48%) women with overt hypothyroidism compared with 0 (0.00%) in both the euthyroid and subclinical hypothyroidism groups ($p < 0.0001$). This finding is consistent with evidence linking maternal hypothyroidism with an increased risk of preterm birth. Korevaar et al. demonstrated an association between maternal thyroid-function abnormalities and preterm birth [21]. The substantially higher frequency of preterm delivery in the overt hypothyroidism group in the present study indicates an association between overt maternal thyroid dysfunction and preterm delivery in this cohort. However, other maternal, obstetric, or clinical factors contributing to preterm delivery may also have influenced this finding. The present study also demonstrated a significantly higher frequency of LSCS among women with subclinical and overt hypothyroidism. This finding requires cautious interpretation because previous LSCS was an important indication for repeat cesarean delivery in the present cohort and may have contributed to the observed difference in overall LSCS rates. Therefore, the higher frequency of LSCS should not be interpreted as being attributable solely to maternal thyroid status. Saki et al. reported an association between abnormal maternal thyroid status and adverse pregnancy outcomes, including differences in cesarean delivery [22].

The neonatal findings further demonstrated an adverse outcome pattern across the maternal thyroid-status groups. Low birth weight occurred in 42 (20.19%) neonates born to euthyroid women, 28 (43.08%) born to women with subclinical hypothyroidism, and 27 (100.00%) born to women with overt hypothyroidism. NICU admission occurred in four (1.92%), 22 (33.85%), and nine (33.33%) neonates, respectively. Low 1-minute APGAR scores were also more frequent among neonates of mothers with overt hypothyroidism, occurring in five (18.52%) compared with four (6.15%) in the subclinical hypothyroidism group and two (0.96%) in the euthyroid group. Casey et al. reported an increased risk of preterm birth among women with subclinical hypothyroidism, while Maraka et al., in a systematic review and meta-analysis, demonstrated associations between subclinical hypothyroidism and adverse pregnancy and neonatal outcomes [23,24]. Dhanwal et al. also reported adverse pregnancy outcomes among women with hypothyroidism in an Indian multicentre cohort [19]. The high frequency of low birth weight observed in the present study, particularly among women with overt hypothyroidism, should be interpreted in the context of gestational age, as 22 (81.48%) women in this group delivered preterm. Low birth weight is not synonymous with FGR and may occur in preterm neonates without FGR. Therefore, the observed difference in low birth weight across thyroid-status groups may partly reflect differences in gestational age at delivery and should not be interpreted exclusively as evidence of impaired fetal growth. Similarly, the higher frequency of NICU admission in the subclinical and overt hypothyroidism groups may have been influenced by prematurity and related neonatal complications.

Mean neonatal TSH increased progressively across the maternal thyroid-status groups, from 8.51 ± 3.40 mIU/L in the euthyroid group to 9.71 ± 3.36 mIU/L in the subclinical hypothyroidism group and 10.97 ± 3.59 mIU/L in the overt hypothyroidism group (ANOVA $F = 8.07$, $p < 0.001$). This finding is supported by Blazer et al., who reported higher neonatal TSH concentrations among infants born to treated hypothyroid mothers compared with controls [25]. Similarly, McGovern et al. highlighted the importance of thyroid-function assessment in neonates born to mothers with hypothyroidism [26]. The progressive increase in mean neonatal TSH observed in the present study suggests an association between maternal thyroid status and neonatal TSH concentrations. However, the overall ANOVA demonstrates a statistically significant difference among the three groups but does not identify which specific groups differed from one another; therefore, pairwise post-hoc comparisons would be required for more precise interpretation. In addition, neonatal TSH values may be influenced by factors such as gestational age, prematurity, and the timing of sample collection. These factors are particularly relevant in the present study because the overt hypothyroidism group had a substantially higher frequency of preterm delivery. Thus, the higher neonatal TSH observed in this group should be interpreted in the context of these factors. The present findings therefore indicate that maternal thyroid dysfunction was associated with differences in neonatal TSH concentrations in this cohort, with the highest mean neonatal TSH observed among neonates born to mothers with overt hypothyroidism.

Strengths and limitations

The strength of the present study is its prospective design, which enabled systematic assessment of maternal thyroid status and subsequent fetomaternal outcomes from antenatal evaluation through delivery. The inclusion of 300 participants and comparison of euthyroid, subclinical hypothyroidism, and overt hypothyroidism groups allowed assessment of outcomes across different degrees of maternal thyroid dysfunction. The use of trimester-specific thyroid-function reference ranges also enabled assessment of maternal thyroid status according to the stage of pregnancy. In addition, the study evaluated multiple maternal and neonatal outcomes, including gestational age at delivery, mode of delivery, birth weight, APGAR scores, NICU admission, and neonatal TSH concentrations, providing a comprehensive assessment of pregnancy and neonatal outcomes.

The study has certain limitations. The single-centre observational design may limit the generalizability of the findings to other populations. The relatively small number of women with overt hypothyroidism may have limited the statistical precision of comparisons involving this subgroup. In addition, potential confounding factors that may influence maternal and neonatal outcomes could not be completely excluded, as multivariable analysis was not performed. The marked difference in preterm delivery across groups may also have contributed to differences in neonatal outcomes, particularly low birth weight and NICU admission. The contribution of previous LSCS to the observed differences in overall cesarean delivery rates should also be considered when interpreting the association between thyroid status and mode of delivery. Furthermore, the significant overall difference in neonatal TSH concentrations requires pairwise post-hoc analysis to determine which thyroid-status groups differed significantly from each other.

Conclusions

The present study demonstrates that maternal thyroid dysfunction, particularly overt hypothyroidism, was associated with adverse fetomaternal and neonatal outcomes, including preterm delivery, higher frequency of operative delivery, low birth weight, lower 1-minute APGAR scores, and increased NICU admission. Neonates born to mothers with overt hypothyroidism also showed higher mean TSH levels. These findings highlight the importance of early identification of thyroid dysfunction during pregnancy, regular monitoring of maternal thyroid function, and timely initiation and optimisation of appropriate treatment. Careful antenatal surveillance and appropriate neonatal assessment may help identify pregnancies and newborns at increased risk of adverse outcomes and facilitate timely clinical intervention. Further multicentre studies with larger samples and adjustment for potential confounding factors are warranted to clarify the independent association between maternal thyroid dysfunction and fetomaternal and neonatal outcomes.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

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