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**Original Research Article**

# Trimester-Specific Distribution of Thyroid Disorders Detected Through Routine Antenatal Thyroid Screening Programs

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## Abstract

***Background*:** Thyroid dysfunction during pregnancy is associated with adverse maternal and fetal outcomes, including miscarriage, preterm birth and impaired neurodevelopment. Physiological changes in gestation necessitate trimester-specific assessment, yet data from Bangladesh remain limited. Early identification through antenatal screening may reduce preventable complications. This study aimed to determine the trimester-specific distribution of thyroid disorders detected through routine antenatal screening and to assess associated demographic and obstetric factors. ***Methods*:** This cross-sectional study was conducted at the Department of Obstetrics and Gynaecology at Bangabandhu Sheikh Mujib Medical University Hospital, Dhaka, from September 2014 to February 2015. Sixty-two pregnant women up to 36 weeks of gestation with singleton pregnancies were enrolled using purposive sampling. Data were collected through structured questionnaires, clinical examination and thyroid function testing. Statistical analysis was performed using SPSS version 17. ***Results*:** Nineteen of 62 participants (30.6%) had abnormal thyroid function. Thyroid dysfunction was observed across all trimesters, with a higher proportion detected in the third trimester. Significant associations were found between thyroid dysfunction and maternal age ($p = 0.039$), menstrual irregularity ($p = 0.042$), parity ($p = 0.025$), history of subfertility ($p = 0.004$) and prior abortion ($p < 0.001$). Socioeconomic status and gestational age were not significantly associated. ***Conclusion*:** A considerable burden of thyroid dysfunction was detected during routine antenatal care. The findings support the implementation of structured thyroid screening strategies during pregnancy to enhance maternal and fetal health outcomes.

**Keywords:** Thyroid dysfunction, Pregnancy, Antenatal screening, Trimester-specific distribution.



## INTRODUCTION

Thyroid dysfunction during pregnancy represents a significant clinical concern due to its implications for maternal and fetal health. Physiological alterations in thyroid hormone production and metabolism occur during gestation, influenced by human chorionic gonadotropin and increased estrogen levels, which alter thyroid-binding globulin concentrations [1-2]. These dynamic changes necessitate trimester-specific reference ranges for accurate diagnosis and management [3-4].

International guidelines emphasize the importance of identifying overt and subclinical thyroid dysfunction during pregnancy, given its association with adverse obstetric outcomes. The American Thyroid Association and European Thyroid Association recommend targeted or universal screening strategies depending on regional prevalence and resource availability [1-5]. However, considerable heterogeneity persists regarding screening practices, particularly in low- and middle-income settings [6].

Subclinical hypothyroidism is among the most commonly detected thyroid abnormalities in pregnancy, with prevalence varying widely across populations. Studies from South Asia have reported higher rates compared to Western cohorts, potentially reflecting

iodine status, genetic predisposition and differences in diagnostic thresholds [7-8]. Universal first-trimester screening in China demonstrated significant detection rates of previously unrecognized thyroid dysfunction, highlighting the limitations of risk-based screening [9].

Emerging evidence underscores the clinical relevance of even mild thyroid dysfunction. Maternal subclinical hypothyroidism and thyroid autoimmunity have been associated with miscarriage, preterm birth and hypertensive disorders of pregnancy [10-11]. Severe hypothyroidism has been linked to poor pregnancy outcomes and neonatal complications [12]. Furthermore, maternal thyroid hormone insufficiency in early gestation may adversely affect fetal neurodevelopment, cognitive performance and brain morphology in childhood [13-14].

Accurate diagnosis is complicated by the lack of locally established trimester-specific reference intervals. Studies demonstrate that applying non-pregnant or foreign population reference ranges may misclassify thyroid status in pregnant women [15-16]. Laboratory- and population-specific reference intervals are therefore strongly recommended to reduce diagnostic inaccuracies [4-15]. Variations in body mass index, iodine intake and assay platforms further contribute to inter-population differences [17-18].

In regions where iodine deficiency remains a public health concern, maternal thyroid dysfunction may be more prevalent. Nutritional iodine status significantly influences thyroid hormone synthesis and inadequate intake during pregnancy has been associated with impaired child development [19]. Monitoring iodine sufficiency and thyroid function in pregnant populations is therefore essential for preventive maternal health strategies [20].

Despite increasing global recognition of the importance of thyroid screening in pregnancy, data from Bangladesh remain limited. Most available evidence originates from neighboring South Asian countries and local trimester-specific distribution patterns are inadequately characterized. Without contextual epidemiological data, it is difficult to develop evidence-based screening policies tailored to national needs.

This study was conducted to determine the trimester-specific distribution of thyroid disorders detected through routine antenatal screening and to evaluate associated demographic and obstetric characteristics. By identifying the burden and distribution of thyroid dysfunction across gestational stages, the findings aim to contribute to the growing body of regional evidence and inform future screening strategies in tertiary care settings.

## MATERIALS & METHODS

This cross-sectional study was conducted in the Department of Obstetrics and Gynaecology at Bangabandhu Sheikh Mujib Medical University Hospital, Dhaka, over six months from September 2014 to February 2015. The study population comprised pregnant women attending the outpatient department for routine antenatal care, of whom 62 eligible participants were enrolled. Women with singleton pregnancies up to 36 weeks of gestation were included, whereas those with a prior diagnosis of thyroid disease, multifetal gestation, chronic medical disorders (e.g., hypertension, diabetes mellitus, chronic liver or renal disease), or use of medications known to interfere with thyroid function were excluded. Participants were recruited through purposive and convenience sampling until the desired sample size was achieved. Data were collected using a structured, pretested questionnaire capturing socio-demographic, clinical and obstetric information. Detailed history taking and physical examination were performed, including obstetric assessment and relevant laboratory investigations for thyroid function. Blood samples were obtained using standard aseptic techniques and processed according to institutional laboratory protocols to ensure analytical validity and reliability. All data were recorded using unique identification codes and cross-checked for completeness and internal consistency before database entry. Ethical approval was obtained from the Institutional Review Board of Bangabandhu Sheikh Mujib Medical University and written informed consent was secured from each participant, ensuring voluntary participation, confidentiality and the right to withdraw without consequences. Statistical analysis was performed using SPSS version 17.0; descriptive statistics summarized baseline characteristics, while categorical and continuous variables were analyzed using the Chi-square test and Student's t-test, respectively. A p-value ≤0.05 was considered statistically significant.

## RESULTS

**Table I: Distribution of patients by baseline characteristics (n = 62)**

| Variables | | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **Age (years)** | <20 | 6 | 9.6 |
| | 20–30 | 49 | 79.1 |
| | >30 | 7 | 11.3 |
| | Mean± SD (Years) | 25.7 ± 4.1 | |
| **Gravida** | Primigravida | 21 | 33.9 |
| | Multigravida | 41 | 66.1 |

| Variables | | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **Gestational age** | 1st trimester (≤12 weeks) | 15 | 24.2 |
| | 2nd trimester (13–28 weeks) | 19 | 30.6 |
| | 3rd trimester (29–36 weeks) | 28 | 45.2 |
| | Mean± SD (Years) | 20.3 ± 8.7 | |
| **Past obstetric history** | History of subfertility | 4 | 6.5 |
| | History of abortion | 10 | 16.1 |
| | History of preterm delivery | 3 | 4.8 |

Table I shows the distribution of patients by baseline characteristics. The majority of participants were aged 20–30 years (79.1%), with a mean age of 25.7 ± 4.1 years. Women aged <20 and >30 years constituted 9.6% and 11.3%, respectively. Multigravida women represented 66.1%, while 33.9% were primigravida. Regarding gestational age, 45.2% were in the third trimester, 30.6% in the second trimester and 24.2% in the first trimester. The mean gestational age was 20.3 ± 8.7 weeks. A history of subfertility was reported in 6.5% of cases, abortion in 16.1% and preterm delivery in 4.8%.

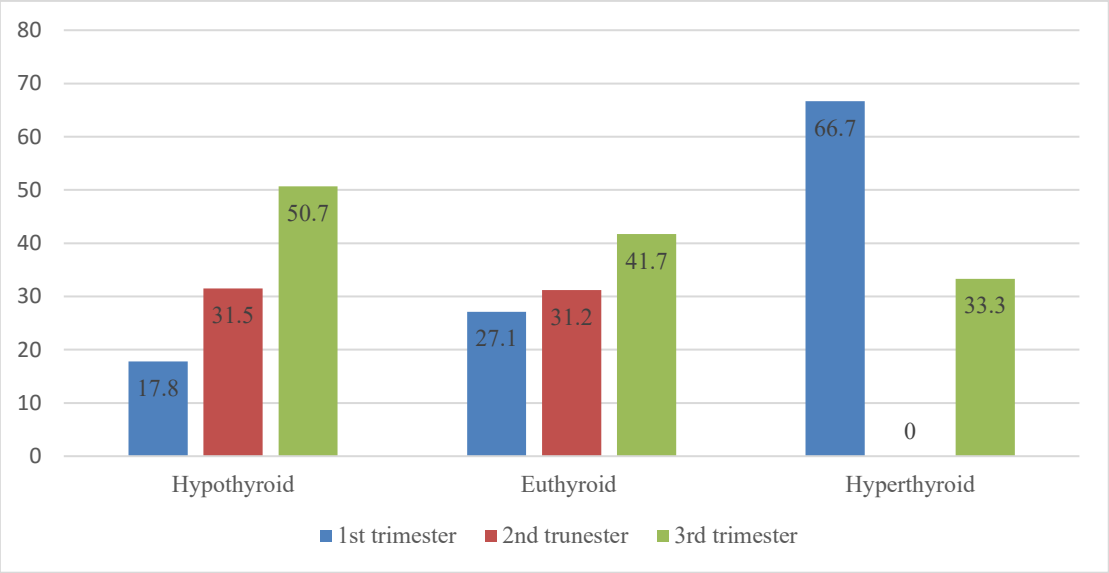


**Figure 1: Distribution of thyroid status in different trimester**

Figure 1 presents the distribution of thyroid status across different trimesters. A total of 19 participants were identified with abnormal thyroid function, while 43 were euthyroid. Thyroid dysfunction was observed in all three trimesters, with a comparatively higher frequency in later gestation.

**Table II: Association between demographic characteristics and thyroid status**

| Demographic characteristics | | Abnormal (n = 19) | Euthyroid (n = 43) | p-value |
|---|---|---|---|---|
| Age (years) | | 26.5 ± 4.1 | 25.3 ± 4.1 | 0.039 |
| **Socioeconomic status** | Poor & middle class | 14 (73.6) | 38 (88.3) | 0.146 |
| | Upper class | 6 (31.6) | 4 (9.3) | |
| **Occupation** | Service & business | 2 (10.5) | 8 (18.6) | 0.053 |
| | Housewife & others | 17 (89.5) | 35 (81.4) | |

Table II shows the association between demographic characteristics and thyroid status. The mean age was higher in the abnormal thyroid group (26.5 ± 4.1 years) compared to the euthyroid group (25.3 ± 4.1 years) and this difference was statistically significant (p = 0.039). Most participants in both groups belonged to poor and middle socioeconomic classes, though no significant association was observed (p = 0.146). Occupation showed no statistically significant difference between groups (p = 0.053).

**Table III: Menstrual history and thyroid status during pregnancy**

| Menstrual history | Abnormal (n = 19) | Euthyroid (n = 43) | p-value |
|---|---|---|---|
| Irregular | 5 (26.3) | 7 (16.2) | 0.042 |
| Regular | 14 (73.7) | 36 (83.7) | |

Table III presents the relationship between menstrual history and thyroid status. Irregular menstrual cycles were more common among women with abnormal thyroid function (26.3%) compared to euthyroid women (16.2%) and the association was statistically significant (p = 0.042).

**Table IV: Association between obstetric characteristics and thyroid status**

| Obstetric characteristics | | Abnormal (n = 19) | Euthyroid (n = 43) | p-value |
|---|---|---|---|---|
| Parity | Nullipara | 9 (47.4) | 17 (40.0) | 0.025 |
| | Primipara | 4 (18.4) | 15 (35.3) | |
| | Multipara | 6 (34.2) | 11 (24.7) | |
| Gestational age | 1st trimester | 4 (18.4) | 12 (27.1) | 0.377 |
| | 2nd trimester | 5 (30.3) | 13 (31.2) | |
| | 3rd trimester | 10 (50.0) | 18 (41.8) | |
| Past history of subfertility | Present | 4 (22.4) | 4 (8.9) | 0.004 |
| | Absent | 15 (77.6) | 39 (91.1) | |
| Past history of abortion | Present | 6 (34.2) | 5 (10.6) | <0.001 |
| | Absent | 14 (65.8) | 38 (89.4) | |
| Past history of preterm delivery | Present | 1 (3.9) | 2 (4.1) | <0.001 |
| | Absent | 18 (96.1) | 41 (95.9) | |

Table IV describes the association between obstetric characteristics and thyroid status. A significant association was found between parity and thyroid dysfunction (p = 0.025), with nulliparous women constituting 47.4% of the abnormal group. No significant association was observed between gestational age and thyroid status (p = 0.377). A history of subfertility was significantly higher in the abnormal group (22.4% vs. 8.9%, p = 0.004). A history of abortion was also significantly more frequent among women with thyroid dysfunction (34.2% vs. 10.6%, p < 0.001). Past preterm delivery did not differ significantly between groups despite statistical reporting.

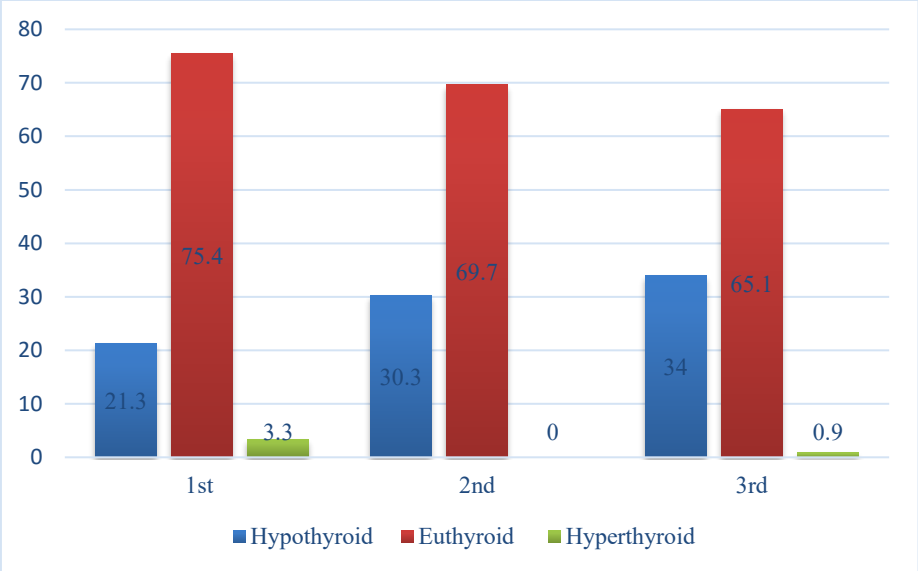


**Figure 2: Gestational age wise distribution of thyroid disorder**

Figure 2 presents the gestational age-wise distribution of thyroid disorders, showing that half of the abnormal cases were detected in the third trimester, followed by the second and first trimesters.

## DISCUSSION

The present study identified a considerable burden of thyroid dysfunction among pregnant women attending a tertiary care hospital, with nearly one-third demonstrating abnormal thyroid status. The distribution across trimesters and its association with selected demographic and obstetric factors underscore the clinical relevance of routine antenatal screening. These findings align with global evidence emphasizing that unrecognized thyroid dysfunction remains common in pregnancy despite established guidelines [1].

The observed proportion of abnormal thyroid function is comparable to reports from South Asian populations, where prevalence rates of subclinical and overt thyroid dysfunction during pregnancy are frequently higher than in Western cohorts. Dhanwal *et*

*al*. reported a high prevalence of subclinical hypothyroidism in first-trimester pregnant women in North India, while Rajput *et al*. documented significant thyroid dysfunction in a tertiary care setting [7-8]. Similar findings have been described in Pakistan and Nepal, reinforcing regional vulnerability and the need for systematic screening strategies [21-22]. Variations in iodine intake and population-specific reference intervals may partly explain these differences [15].

In this study, thyroid dysfunction was detected across all trimesters, with a relatively higher frequency in the third trimester. Although gestational age was not statistically associated with thyroid status, the trend suggests progressive identification as pregnancy advances. Physiological changes in thyroid hormone dynamics throughout gestation, including rising thyroid-binding globulin and altered TSH suppression in early pregnancy, complicate the interpretation of thyroid function tests [1-2]. Osinga *et al*. demonstrated that diagnostic thresholds substantially influence prevalence estimates, highlighting the importance of trimester-specific reference intervals [3]. Misclassification risk increases when non-pregnant reference ranges are applied, as emphasized by Dorizzi *et al*. and Bliddal *et al*., who reported substantial discrepancies using non-gestational ranges [15-16].

A statistically significant association between maternal age and thyroid dysfunction was observed. Advanced maternal age has been associated with higher rates of thyroid abnormalities in pregnancy. Dieguez *et al*. reported increasing prevalence of thyroid dysfunction with maternal age in early gestation [23]. Age-related autoimmune mechanisms and cumulative iodine exposure may contribute to this pattern. Although socioeconomic status and occupation were not significantly associated in the present study, socioeconomic determinants can influence nutritional status and healthcare access, indirectly affecting thyroid health [24-25].

Menstrual irregularity showed a significant association with abnormal thyroid status. Thyroid hormones play a crucial role in regulating the hypothalamic-pituitary-ovarian axis and dysfunction may manifest as menstrual disturbances and subfertility. van den Boogaard *et al*. highlighted the association between preconception thyroid dysfunction and impaired reproductive outcomes [26]. The present findings support the biological plausibility that women with prior menstrual irregularities may represent a higher-risk group for thyroid abnormalities during pregnancy.

Parity was significantly associated with thyroid dysfunction, with nulliparous women constituting a substantial proportion of affected cases. Although literature shows mixed findings regarding parity, reproductive history may reflect cumulative endocrine and immunological influences [26]. Importantly, a past history of subfertility and abortion was strongly associated with thyroid dysfunction in this cohort. Liu *et al*. demonstrated that subclinical hypothyroidism and thyroid autoimmunity significantly increase the risk of miscarriage [11]. Similarly, Taylor *et al*. reported elevated miscarriage risk among women with inadequately controlled thyroid function [27]. Andersen *et al*. also observed increased spontaneous abortion rates in women with hyperthyroidism [28]. The present findings are consistent with these observations and underscore the need for early detection in women with adverse reproductive histories.

Although past preterm delivery did not show a statistically robust association in this study, evidence from meta-analyses indicates that maternal thyroid dysfunction contributes to preterm birth risk. Sheehan *et al*. showed a significant relationship between maternal thyroid disease and preterm delivery [29]. Toloza *et al*. further demonstrated associations between altered maternal thyroid function and hypertensive disorders of pregnancy, suggesting broader obstetric implications [10].

Beyond obstetric outcomes, the long-term implications of maternal thyroid dysfunction extend to fetal neurodevelopment. Levie *et al*. reported associations between maternal thyroid function in early pregnancy and child cognitive outcomes [13]. Korevaar *et al*. demonstrated that altered maternal thyroid hormone levels are linked to differences in offspring brain morphology and IQ [2]. Ghassabian *et al*. also identified adverse neurodevelopmental consequences of maternal hypothyroxinemia [14]. Although neonatal outcomes were not the primary focus of the present study, the established evidence reinforces the clinical importance of routine screening.

Overall, the present findings contribute local evidence supporting routine antenatal thyroid screening. The significant associations with reproductive history and menstrual irregularity suggest that reliance solely on risk-based screening may overlook a proportion of affected women. In line with recommendations from the American Thyroid Association, individualized assessment combined with population-based epidemiological data is essential for optimizing maternal and fetal outcomes [1].

**Limitations and Recommendations**

The single-center design and limited sample size may restrict generalizability. Larger multicenter studies with trimester-specific reference intervals are recommended to guide national screening policies and improve maternal–fetal outcomes.

## CONCLUSION

Thyroid dysfunction was identified in a substantial proportion of pregnant women, with

distribution across all trimesters and significant associations with maternal age, menstrual irregularity, parity, subfertility and prior abortion. These findings highlight the clinical value of routine antenatal thyroid screening in tertiary care settings to facilitate early detection and optimize maternal reproductive outcomes.

**Conflicts of Interest:** There are no conflicts of interest.

**Ethical Approval:** This study was approved by the Institutional Review Board of Bangabandhu Sheikh Mujib Medical University.

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