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ORIGINAL ARTICLE

# Frequency of thyroid dysfunction in antenatal patients visiting the tertiary care hospital.

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**ABSTRACT… Objective:** To determine the frequency of thyroid dysfunction and its subtypes among antenatal patients, and to analyze the relationship between thyroid dysfunction and selected sociodemographic, obstetric, and clinical parameters. **Study Design:** Cross-sectional Prospective study. **Setting:** Department of Obstetrics-Gynecology Unit-2 of Dr. Ruth K. M. Pfau, Civil Hospital Karachi, Pakistan. **Period:** October 1st, 2025, to March 31st, 2026. **Methods:** A total of 177 pregnant women attending the outpatient department were recruited through consecutive sampling. A detailed clinical history and relevant demographic information were recorded in a pre-designed proforma. In addition, to routine antenatal investigations, thyroid profile including serum thyroid-stimulating hormone (TSH) levels, free triiodothyronine (FT3) and free thyroxine (FT4) levels were measured in all participants. Thyroid status was categorized using trimester-specific reference ranges. Data were analyzed via SPSS. A p-value of <0.05 is considered as significant. **Results:** The overall prevalence of thyroid dysfunction among pregnant women was found to be 14.1% (25/177), with the majority of cases being subclinical hypothyroidism (6.78%), followed by overt hypothyroidism (2.82%), subclinical hyperthyroidism (3.39%), and overt hyperthyroidism (1.13%). A significant association was observed between thyroid dysfunction and age (p=0.008) and pregnancy-induced hypertension PIH(p=0.012), while no significant associations were observed with education, occupation, trimester, gravida, BMI, anemia, or gestational diabetes mellitus. **Conclusion:** The study found a moderate prevalence of thyroid dysfunction. These findings highlight thyroid dysfunction as an important antenatal health concern and support targeted screening, particularly in older pregnant women and those with pregnancy-induced hypertension, to improve maternal outcomes.

**Key words:** Hypothyroidism, Pregnancy, Subclinical Hypothyroidism, Thyroid Dysfunction, Thyroid-Stimulating Hormone (TSH).

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## INTRODUCTION

Thyroid dysfunction is the second most common endocrine disorder after gestational diabetes mellitus in pregnant women and poses significant challenges for clinical diagnosis, as its symptoms often overlap with those of normal pregnancy. Pregnancy is associated with significant physiological and hormonal changes that alter thyroid gland function, which plays a crucial role across all three trimesters.[1]

In the first trimester, fetal growth and neurodevelopment are entirely dependent on maternal thyroid hormones, which cross the placenta and enter the fetal circulation. In women with normal thyroid function, the production of triiodothyronine (T3) and thyroxine (T4) increases, leading to suppression of thyroid-stimulating hormone (TSH). This is primarily due to the structural similarity between human chorionic gonadotropin (hCG) and TSH. Additionally, elevated estrogen levels during pregnancy increase the production of thyroid-binding globulin, reducing the availability of free T4 and consequently stimulating increased T4 production.

During the second trimester, although the fetal thyroid gland begins to produce its own hormones, the production remains insufficient, and fetal requirements are still largely met by maternal hormones. By the third trimester, fetal thyroid hormone production increases; however, maternal thyroid hormones continue to cross the placenta and play an important role in the final stages of fetal brain development and maturation.[2]

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Therefore, early detection and timely management of thyroid disorders in pregnant women are critical. Maternal thyroid dysfunction is associated with adverse obstetric and fetal outcomes. Untreated overt and, more importantly, subclinical thyroid dysfunction are associated with an increased risk of miscarriage, anemia, preeclampsia, placental abruption, intrauterine growth restriction, stillbirth, preterm delivery, and postpartum hemorrhage, as well as maternal complications such as myopathy and congestive heart failure.[3] The consequences are not limited to maternal health but also affect fetal neuropsychological and neurocognitive development, leading to neonatal thyroid disorders, hyperbilirubinemia, and attention deficit and hyperactivity disorders.[4]

Globally, the prevalence of thyroid dysfunction among pregnant women varies widely depending on the population characteristics and study design, ranging from 2–3% for overt disease to higher estimates exceeding 30% when subclinical cases are included.[5] A recent study in India reported a prevalence of 33.9%, with hypothyroidism being more common than hyperthyroidism, highlighting it as a growing public health concern. This higher burden is particularly observed in Asian countries, possibly due to insufficient iodine intake.[6] Consistent with this, other studies have reported that the prevalence of overt and subclinical hypothyroidism during pregnancy ranges from 3–4.58% and 6.47–9%, respectively, whereas overt and subclinical hyperthyroidism affect approximately 0.4–1.7% and 0.4–0.7% of pregnancies.[7] Similarly, studies from Bangladesh and Nepal have reported prevalence rates of 34.98% and 29%, respectively.[8,9] These findings indicate a higher prevalence of thyroid dysfunction, particularly hypothyroidism, among pregnant women in South Asian populations.
However, data on the prevalence of thyroid dysfunction in Pakistan remain limited and outdated. Given the increasing incidence and serious consequences, there is a need for updated evidence to guide screening and management strategies. Therefore, this study aims to determine the prevalence and pattern of thyroid dysfunction among pregnant women in Karachi, Pakistan, an urban city with a diverse population and varied sociodemographic characteristics. The secondary objectives include assessing the frequency of different categories of thyroid dysfunction, trimester-wise distribution, and their association with sociodemographic, obstetric, and clinical characteristics. This information may help in developing population-specific strategies for accurate diagnosis and effective management of thyroid dysfunction in pregnancy.

## METHODS

This cross-sectional study was conducted over a period of six months from October 1st, 2025, to March 31st, 2026, in the Department of Obstetrics and Gynecology, Unit II, Civil Hospital Karachi, a tertiary care hospital in Karachi, Pakistan.

A sample size of 177 was calculated using a single population proportion formula, assuming a prevalence of thyroid dysfunction of 13.2%[10] among antenatal patients, with a 95% confidence level and a margin of error of 3.5%.

Pregnant women attending routine antenatal checkups during the study period and willing to participate were recruited using a non-probability consecutive sampling technique. Eligible participants were enrolled until the required sample size was achieved. Women aged 18–40 years with a singleton pregnancy of any gestational age were included, irrespective of their socio-demographic characteristics. Women with multiple pregnancies, a bad obstetric history, gestational trophoblastic disease, a previous history of thyroid surgery, current or previous treatment for thyroid disorders, or use of medications known to affect thyroid functions were excluded. In addition, women with preexisting medical conditions, including diabetes mellitus, hypertension, seizure or other convulsive disorders, pituitary or adrenal disease, malignancy, severe gastrointestinal disease, blood disorders, and cerebrovascular disease, were not included in this study.

Participants who were unwilling to provide informed consent were also excluded. A structured data collection proforma was used to collect information from the participants, developed in accordance with relevant available literature and study objectives. The proforma was designed to collect comprehensive information on participants' socio-

demographic characteristics, obstetric history, clinical parameters, and biochemical thyroid profile. The proforma included variables such as unique patient identification number, age, gestational age (in weeks), gravidity, parity, body mass index (BMI), trimester, serum thyroid-stimulating hormone (TSH), free thyroxine (FT4), and free tri-iodothyronine (FT3) levels. It also included maternal conditions, including anemia, gestational diabetes mellitus (GDM), and pregnancy-induced hypertension, along with socio-demographic factors such as education level and occupation. Gestational age for each participant was determined based on the most recent ultrasound examination and used to classify pregnancy into three trimesters. The first trimester corresponded to gestational age up to 13 weeks, the second trimester to 14–27 weeks, and the third trimester to >27 weeks.[11] Information on maternal conditions such as anemia, gestational diabetes mellitus (GDM), and pregnancy-induced hypertension (PIH) was obtained from their antenatal cards (history file). The demographic data were filled in by participants.

For the assessment of biochemical parameters, including thyroid-stimulating hormone (TSH), free tri-iodothyronine (FT3), and free thyroxine (FT4), approximately 5 mL of venous blood was collected from each patient during daytime hours under aseptic conditions. Each sample was labeled with a unique patient identification number and transported to the Civil Hospital Karachi (CHK) Central Lab immediately for analysis. Serum was separated and analyzed for TSH, FT3, and FT4 levels using a chemiluminescence immunoassay (CLIA) system following standard laboratory protocols. Trimester-specific reference ranges for thyroid function parameters (Table-I) were utilized for interpretation, based on established values reported in the local population, in accordance with the recommendations of the American Thyroid Association (ATA) guidelines for the assessment of thyroid function during pregnancy.[12]

Thyroid function status was classified based on serum concentrations of TSH, FT3, and FT4 levels, and participants were categorized into five groups. Euthyroid status corresponds to values of TSH, FT3, and FT4 within the reference range. Subclinical hypothyroidism was characterized as an elevated serum TSH level with normal FT3 and FT4 levels. Whereas overt hypothyroidism results from elevated serum TSH levels with low FT3 and/or FT4 levels. Subclinical hyperthyroidism was characterized by a low level of serum TSH accompanied by normal levels of FT3 and FT4. Overt hyperthyroidism corresponds to suppressed levels of TSH along with elevated levels of serum FT3 or/and FT4 concentration.[13]

The study protocol was reviewed and approved by the Institutional Ethics Committee of the Dow Medical College and University, Civil Hospital, Saddar, Karachi, Pakistan (IRB-4335/DUHS/Approval No. 2025/16). The study was initiated after obtaining approval from the College of Physicians and Surgeons of Pakistan (CPSP). All patients were asked to provide written informed consent and were briefly informed about the study protocol. Each participant was assigned a unique ID to ensure anonymity. All data were anonymized prior to analysis, and no personally identifiable information was accessed or disclosed.

The data were transferred to MS Excel 2017 from the proforma. All analyses were done using Statistical Package for social sciences (SPSS) for Windows version 26.0 (SPSS Inc., Chicago, IL). Descriptive statistics were used to summarize the study data. Continuous variables were expressed as mean ± standard deviation, while categorical data were expressed as frequencies and percentages. The prevalence of thyroid dysfunction and each category was calculated.

**TABLE-I**

**Trimester-specific reference ranges for thyroid function tests (TSH, FT3, and FT4) during pregnancy**

| S.No | Trimester of Pregnancy | Parameters Reference ranges | | |
|---|---|---|---|---|
| | | TSH (mIU/mL) | FT3 (pmol/L) | FT4 (pmol/L) |
| 1 | 1st trimester | 0.168 – 4.294 | 1.857 – 4.408 | 8.815 – 18.006 |
| 2 | 2nd trimester | 0.258 – 4.584 | 1.958 – 4.621 | 8.306 – 17.341 |
| 3 | 3rd trimester | 0.341 – 4.625 | 2.025 – 4.821 | 7.402 – 17.292 |

Thyroid dysfunction (five categories) and its association with categorical variables (demographic and obstetric variables) were assessed using the chi-square test or Fisher's exact test as appropriate based on cell count. A p-value of less than 0.05 was considered statistically significant.

## RESULTS

### Characteristics of the study Participants

A total of 177 participants filled out the proforma and were included in the study. The participants' age ranges from 18 to 40 years. The distribution of participants according to their sociodemographic characteristics (age, education, and occupation), Obstetric characteristics (gestational age, trimester status, gravida, and parity), and clinical characteristics (Body mass Index (BMI), Anemia, Gestational Diabetic mellitus (GDM), Pregnancy Induced Hypertension (PIH) is presented in Table-II.

**TABLE-2 (A)**

**Baseline characteristics of the study participants (continuous variables presented as mean ± SD)**

| Sr. No | Variable | Mean ± SD |
|---|---|---|
| 1 | Age (years) | 29 ± 6.5 |
| 2 | Gestational age (weeks) | 23.05 ± 10.1 |
| 3 | BMI (kg/m²) | 27.04 ± 4.7 |

BMI = Body Mass Index

### Prevalence of Thyroid dysfunction

The data revealed that the overall prevalence of thyroid dysfunction among pregnant women attending the tertiary care hospital was 14.1% (25/177), while most of the participants (152/177) were euthyroid. Thyroid dysfunction was further classified into five categories, and among the different categories, subclinical hypothyroidism was more prevalent (n=12). The mean TSH level was highest in the hypothyroid group, particularly in overt hypothyroidism (9.88 ± 1.44 mIU/L), while the lowest levels were observed in hyperthyroid participants. Variations in fT4 and fT3 levels were also noted across different thyroid categories, reflecting the biochemical differences between euthyroid and dysfunctional states (Table-III)

**TABLE-2 (B)**

**Baseline characteristics of the study participants (categorical variables presented as frequency and percentage)**

| Sr. No | Variable | Category/ measure | Frequency (n) | Percentages (%) |
|---|---|---|---|---|
| **Socio-Demographic Characteristics** | | | | |
| 1 | Education | No formal Education | 132 | 74.6 |
| | | Primary | 27 | 15.3 |
| | | Secondary | 6 | 3.4 |
| | | Matric | 12 | 6.8 |
| 2 | Occupation | Housewife | 141 | 79.7 |
| | | Employed | 36 | 20.3 |
| **Obstetric Characteristics** | | | | |
| 3 | Trimester Status | 1st trimester | 43 | 24.3 |
| | | 2nd trimester | 65 | 36.7 |
| | | 3rd trimester | 69 | 39 |
| 4 | Gravida | Primigravida | 33 | 18.6 |
| | | Multigravida | 144 | 81.4 |
| **Clinical Characteristics** | | | | |
| 5 | Anemia | Yes | 75 | 42.4 |
| | | No | 102 | 57.6 |
| 6 | GDM | Yes | 94 | 53.1 |
| | | No | 83 | 46.9 |
| 7 | PIH | Yes | 79 | 44.6 |
| | | No | 98 | 55.4 |

GDM = Gestational Diabetes Mellitus; PIH = Pregnancy-Induced Hypertension.

### Distribution of thyroid dysfunction across sociodemographic factors

The association of different categories of thyroid dysfunction with socio-demographic factors revealed no significant relationship with education and occupation (p=0.731 and p=0.285), respectively. In contrast, age showed a significant relationship (p=0.008) as shown in Table 4. However, some thyroid dysfunction categories, especially overt hyperthyroidism and overt hypothyroidism, contains small sample sizes, which may limit the stability and generalizability of subgroup analyses despite the use of Fisher's exact test. Although the 31-35-year age group comprises a small proportion of the sample, a considerable number of thyroid dysfunction cases (11/25) were observed within this group.

### Thyroid Dysfunction and Obstetric Characteristics

The distribution of thyroid dysfunction across trimesters did not show a significant association (P=0.237). Euthyroid patients were observed across all trimesters, with the largest number in the third trimester. A higher number of thyroid dysfunctions were observed in the 2nd trimester, with 12 /25 cases. Similarly, no significant association was observed between gravida and thyroid dysfunction (p=0.560). The majority of the participants, including normal (euthyroid) and those with thyroid dysfunction, were multigravida. No clear pattern was observed between the gravida and thyroid dysfunction category.

**TABLE-III**

**Prevalence and biochemical profile of thyroid dysfunction among antenatal women**

| Thyroid Categories | Sub Types | Frequency | Proportion | TSH (mIU/L) | fT4 (pmol/ L) | fT3 (pmol/L) |
|---|---|---|---|---|---|---|
| | | N (177) | % | Mean ± SD | Mean ± SD | Mean ± SD |
| Euthyroid | - | 152 | 85.9 | 2.49 ± 1.08 | 17.35 ± 3.97 | 4.57 ±1.20 |
| Thyroid dysfunction (overall) | Hypo+Hyper | 25 | 14.1 | - | - | - |
| Hyperthyroidism | Subclinical | 6 | 3.4 | 0.032±0.02 | 20±3.44 | 3.03±1.63 |
| | Overt | 2 | 1.1 | 0.023±0.02 | 17.32±17.93 | 6.31±3.79 |
| | Total | 8 | 4.5 | - | - | - |
| Hypothyroidism | Subclinical | 12 | 6.8 | 8.10±2.17 | 16.32±4.12 | 5.20±1.41 |
| | Overt | 5 | 2.8 | 9.88±1.44 | 6.33±2.50 | 1.80±1.53 |
| | Total | 17 | 9.6 | - | - | - |

TSH = Thyroid Stimulating Hormone; fT3 = Free Triiodothyronine; fT4 = Free Thyroxine.
Values are expressed as frequency (n) and percentage (%) for categorical variables, and Mean ± standard deviation (SD) for continuous variables.

**TABLE-IV**

**Relationship between thyroid dysfunction and socio-demographic factors in antenatal patients**

| Variable Categories N (%) | | Euthyroid | Hypothyroidism | | Hyperthyroidism | | P-Value |
|---|---|---|---|---|---|---|---|
| | | (n=152) | Overt (n=5) | Subclinical (n=12) | Overt (n=2) | Subclinical (n=6) | |
| | | N (%) | N (%) | N (%) | N (%) | | |
| Age (years) | 18-25 | 55(36.2) | 1(20) | 3(25) | 1(50) | 0 | 0.008* |
| | 26-30 | 36(23.7) | 0 | 0 | 1(50) | 1(16.7) | |
| | 31-35 | 28(18.4) | 4(80) | 5(41.7) | 0 | 2(33.3) | |
| | >35 | 33(21.7) | 0 | 4(33.3) | 0 | 3(50.0) | |
| Education | No Formal Education | 114(75) | 3(60.0) | 8(66.7) | 2(100) | 5(83.4) | 0.731 |
| | Primary | 22(14.4) | 2(40.0) | 3(25) | 0 | 0 | |
| | Secondary | 6(3.94) | 0 | 0 | 0 | 0 | |
| | Matric | 10(6.5) | 0 | 1(8.3) | 0 | 1(16.4) | |
| Occupation | Housewife | 124 (81.6) | 4(80) | 8(66.7) | 1(50) | 4(66.7) | 0.285 |
| | employed | 28(18.4) | 1(20) | 4(33.3) | 1(50) | 2(33.3) | |

Values are expressed as frequency (n) and percentage (%). Statistical significance was assessed using the Fisher's exact test. A p-value ≤ 0.05 was considered statistically significant (*).

**TABLE-V**

**Relationship between thyroid dysfunction and obstetric factors in antenatal patients**

| Variable Categories N (%) | | Euthyroid (n=152) | Hypothyroidism | | Hyperthyroidism | | P-Value |
|---|---|---|---|---|---|---|---|
| | | | Overt (n=5) | Subclinical (n=12) | Overt (n=2) | Subclinical (n=6) | |
| | | N (%) | N (%) | N (%) | N (%) | | |
| Trimester Status | 1st trimester | 36(23.7) | 0 | 5(41.7) | 1(50.0) | 1(16.7) | .237 |
| | 2nd trimester | 53(34.9) | 4(80.0) | 4(33.3) | 0 | 4(66.7) | |
| | 3rd trimester | 63(41.4) | 1(20.0) | 3(25.0) | 1(50.0) | 1(16.7) | |
| Gravida | Primigravida | 27(17.8) | 1(20.0) | 3(25.0) | 1(50.0) | 1(16.7) | .560 |
| | Multigravida | 125(82.2) | 4(80.0) | 9(75.0) | 1(50.0) | 5(83.3) | |

Values are expressed as frequency (n) and percentage (%). Statistical significance was assessed using the Fisher's exact test. A p-value ≤ 0.05 was considered statistically significant (*).

**TABLE-VI**

**Relationship between thyroid dysfunction and clinical profile of antenatal patients**

| Variable Categories N (%) | | Euthyroid (n=152) | Hypothyroidism | | Hyperthyroidism | | P-Value |
|---|---|---|---|---|---|---|---|
| | | | Overt (n=5) | Subclinical (n=12) | Overt (n=2) | Subclinical (n=6) | |
| | | N (%) | N (%) | N (%) | N (%) | | |
| BMI | Normal | 47(30.9) | 2(40.0) | 2(16.7) | 0 | 3(50.0) | 0.350 |
| | Overweight | 58 (38.2) | 2(40.0) | 7(58.3) | 0 | 3(50.0) | |
| | Obese | 47(30.9) | 1(20.0) | 3(25.0) | 2 (100.0) | 0 | |
| Anemia | Anemic | 63(41.4) | 1(20.0) | 7(58.3) | 0 | 4(66.7) | 0.307 |
| | Non-Anemic | 89(58.6) | 4(80.0) | 5(41.7) | 2(100) | 2(33.3) | |
| PIH | Yes | 65(42.8) | 1(20.0) | 5(41.7) | 2(100) | 6(100) | 0.012* |
| | NO | 87(57.2) | 4(80.0) | 7(58.3) | 0 | 0 | |
| GDM | Yes | 82(53.9) | 1(20.0) | 5(41.7) | 1(50) | 5(83.3) | 0.255 |
| | NO | 70(46.1) | 4(80.0) | 7(58.3) | 1(50) | 1(16.7) | |

Values are expressed as frequency (n) and percentage (%). Statistical significance was assessed using the Fisher's exact test. A p-value ≤ 0.05 was considered statistically significant (*).
BMI = Body Mass Index; GDM = Gestational Diabetes Mellitus; PIH = Pregnancy-Induced Hypertension

### Clinical Profile of Thyroid Dysfunction

The association between thyroid dysfunction and clinical profiles of the participants showed no significant relationship with BMI (p=0.350), anemia (p=0.307), and gestational diabetes mellitus (p=0.255), respectively. The thyroid dysfunction cases were found in all BMI groups with no specific pattern; also, no clear pattern was observed in thyroid dysfunction in relation to anemic and non-anemic participants and GDM positive and negative participants. In contrast, pregnancy-associated hypertension (PIH) showed a significant association with thyroid dysfunction (p=0.012). A higher proportion of thyroid dysfunction cases, particularly hyperthyroidism, was observed among participants with PIH. However, the number of hyperthyroid cases was very small therefore, this observation should be interpreted with caution and is better considered as an exploratory finding rather than a definitive association

## DISCUSSION

Pregnancy is a complex physiological process during which the demand for thyroid hormones increases significantly. To meet this increased requirement, a healthy and well-functioning thyroid gland is essential for maintaining hormonal balance throughout pregnancy. This is particularly important because maternal thyroid hormones play a critical role in fetal growth, brain development, and overall

pregnancy outcomes.[14]

The present study was conducted to determine the prevalence of thyroid dysfunction among pregnant women in one of the busiest and most densely populated cities of Pakistan, characterized by a diverse population.

In this study, the prevalence of thyroid dysfunction was found to be 14.1%, which is lower than that reported in a previous study conducted in the same setting, where a prevalence of 19.8% was observed.[15] This difference may be attributed to the use of different diagnostic criteria for identifying thyroid dysfunction among participants. In the referenced study, relatively stricter trimester-specific TSH cut-off values (e.g., an upper limit of 2.5 mIU/mL in the first trimester) were used, which may have led to a higher detection rate. Additionally, the inclusion of women at earlier gestational ages (8–26 weeks) in the comparative study may have contributed to increased detection of thyroid abnormalities, as hormonal fluctuations are more pronounced during early pregnancy. The present study used trimester-specific reference ranges derived from a recent study conducted in a similar population[12], which provides a more reliable estimate of thyroid dysfunction compared to universal cut-offs, as thyroid hormone levels can vary depending on ethnicity, iodine status, nutritional factors, and environmental influences.[16] The American Thyroid Association (ATA) guidelines also emphasize the importance of using population-specific, trimester-specific TSH reference ranges due to physiological variations.[17] These methodological differences highlight the importance of standardized diagnostic criteria when comparing prevalence across studies.

Among the various categories of thyroid dysfunction, subclinical hypothyroidism affected the largest proportion of pregnant women, with a prevalence of 6.78%, followed by subclinical hyperthyroidism (3.39%), overt hypothyroidism (2.82%), and overt hyperthyroidism (1.13%). A similar pattern was reported by.[10] The literature indicates that subclinical hypothyroidism is more common in pregnant women, which is also supported by the findings of this study, and is associated with several adverse maternal and fetal outcomes. This pattern is consistent with previous literature, where mild or subclinical abnormalities are often more common during pregnancy due to physiological hormonal fluctuations. Studies by Dhanwal DK et al[18] and Gayathri R et al[19] have similarly reported that subclinical hypothyroidism constitutes the largest proportion of thyroid dysfunction cases in pregnant populations. In addition, a meta-analysis by Maraka S et al. demonstrated that subclinical thyroid disorders are more prevalent than overt forms across diverse populations.[20] Comparable trends have also been observed in Asian cohorts, including the study by Wang S et al., further supporting the predominance of subclinical presentations.[21]

The age-wise distribution of participants in this study indicates that thyroid disorders were most commonly observed in women aged 30–35 years. This finding differs from earlier reports that show a higher prevalence in younger age groups. Such variation may reflect changing demographic trends, including delayed marriage and childbirth, as well as longer intervals between pregnancies. These observations highlight the need to evaluate pre-existing thyroid dysfunction and support universal screening before pregnancy.[22]

A higher proportion of thyroid dysfunction, especially hypothyroidism, was observed among unemployed women compared to employed women; however, this association was not statistically significant. The majority of pregnant women with thyroid disorders in this study had lower levels of education. Although this association was not statistically significant, it may contribute to limited awareness, delayed recognition of early symptoms, inappropriate health-seeking behavior, and ultimately an increased risk of pregnancy-related complications.[23]

Generally, thyroid function tests are not routinely performed in government healthcare sectors, and many individuals neglect advised thyroid profile testing due to a lack of awareness and the high cost of testing in private sectors. This may result in missed opportunities for early detection and management, leaving many cases undiagnosed and increasing the risk of pregnancy-related complications. These challenges highlight the importance of strengthening the healthcare system

with basic facilities and support to enable universal screening of thyroid function in antenatal care, thereby reducing complications associated with thyroid dysfunction.

Obstetric factors such as trimester were assessed for their association with thyroid dysfunction, and no significant relationship was found. However, a closer examination of the data shows that thyroid dysfunction was present across all trimesters, with a relatively higher number of hypothyroid cases in the first and second trimesters (n = 6 and n = 8). This pattern may be related to normal physiological changes in early pregnancy, when human chorionic gonadotropin (hCG) levels can temporarily influence thyroid function.[24]

Similarly, no significant association was observed between thyroid dysfunction and gravidity. Although some previous studies have reported a significant relationship between higher gravidity and thyroid disorders, the findings of this study showed a greater proportion of thyroid dysfunction cases among multigravida women.[25] This could be due to the gradual depletion of micronutrient stores and physiological reserves with repeated pregnancies, which may increase vulnerability to thyroid dysfunction, as also suggested in previous studies.

Furthermore, the present study included key clinical parameters such as body mass index (BMI), anemia, gestational diabetes mellitus (GDM), and pregnancy-induced hypertension (PIH) to assess their relationship with thyroid dysfunction during pregnancy. No significant association was observed with BMI, and no consistent trend was noted across BMI categories (normal, overweight, and obese). However, the data showed a higher proportion of hypothyroid cases among participants with BMI >25 kg/m$^2$. A similar observation was reported by Han et al. (2015).[26]

Similarly, the association between anemia and thyroid dysfunction was not statistically significant in this study. Previous studies have reported that iron deficiency may impair the activity of the heme-dependent enzyme thyroid peroxidase, which is essential for thyroid hormone synthesis. In this way, anemia may be linked with thyroid dysfunction.[27] This suggests that screening for thyroid disorders in iron-deficient anemic women may be beneficial for early detection and timely management, helping to reduce the risk of associated complications. Several studies have reported the co-occurrence of gestational diabetes mellitus (GDM) and thyroid dysfunction. In the present study, although a higher proportion of GDM was observed in some thyroid dysfunction groups, this association was not statistically significant. The coexistence of these conditions may be explained by shared physiological mechanisms, particularly increased insulin resistance during pregnancy, which may be influenced by thyroid hormone levels.[28]

In contrast, pregnancy-induced hypertension (PIH) showed a statistically significant association with thyroid dysfunction ($p = 0.012$). A greater proportion of women with thyroid abnormalities, particularly those with overt and subclinical disorders, were affected by PIH compared to euthyroid women. This finding supports a potential link between thyroid dysfunction and hypertensive disorders in pregnancy, possibly due to shared vascular and metabolic pathways that affect placental function and endothelial regulation.[29]

A limitation of the present study is that, although age and PIH were significantly associated with thyroid dysfunction in the univariable analysis, adjustment for potential confounding factors such as trimester, BMI, gravida, anemia, and GDM was not performed. The relatively small number of participants in certain thyroid dysfunction categories, particularly overt hypothyroidism and overt hyperthyroidism, limited the feasibility of conducting a reliable regression analysis. Therefore, the observed associations between age, PIH, and thyroid dysfunction should be interpreted with caution. Future studies with larger sample sizes are needed to confirm these findings after accounting for potential confounders.

Overall, the findings of this study highlight several important factors associated with thyroid dysfunction during pregnancy. The use of population-specific, trimester-specific reference ranges for characterizing thyroid status enabled a more accurate identification of the prevalence of thyroid dysfunction among pregnant women. However, the

relatively small sample size and the hospital-based study setting limit the generalizability and statistical strength of these findings.

## CONCLUSION

In conclusion, this study shows that thyroid dysfunction is relatively common among pregnant women, with subclinical hypothyroidism being the most frequent form. Although most clinical and demographic factors were not statistically significant, some trends were observed that may indicate potential risk groups. The significant association between thyroid dysfunction and pregnancy-induced hypertension further supports the importance of routine thyroid assessment during pregnancy.

These findings also emphasize the importance of using population-based, trimester-specific screening approaches, especially in resource-limited settings where many cases remain undiagnosed. This study supports the development of strategies for early detection and proper management of thyroid dysfunction, which may help reduce adverse maternal and fetal outcomes. Future large-scale, multicenter studies are recommended to further validate these findings.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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| AUTHORSHIP AND CONTRIBUTION DECLARATION | |
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| 2 | **Shakira Parveen:** concept, critically manuscript review. |
| 3 | **Urooj Naz:** Data collection, writing, data interpretation. |
| 4 | **Fariha Shirazi:** Data interpretation. |
| 5 | **Aqsa Anis:** Critically review. |
| 6 | **Saman Naz:** Critical revisions. |