# Thyroid Profile Changes in Pregnancy (T3, T4, TSH)


## Abstract

Pregnancy brings about significant physiological and hormonal changes that impact the normal functioning of the maternal endocrine system, particularly the thyroid gland. Thyroid hormones play a vital role in maternal well-being, fetal growth, and neurological development. This comparative study analyzes the thyroid profile—Triiodothyronine (T3), Thyroxin (T4), and Thyroid-Stimulating Hormone (TSH)—among 100 women, including 50 pregnant and 50 non-pregnant participants.

The study observed that pregnant women exhibited markedly increased levels of T3 and T4, while TSH levels were significantly lower when compared to non-pregnant women. These variations arise due to human chorionic gonadotropin (HCG) stimulation of the thyroid gland and increased estrogen-mediated synthesis of thyroid-binding globulin (TBG). The findings highlight the need for trimester-specific thyroid reference ranges to prevent misdiagnosis and unnecessary treatment.

The research concludes that pregnancy-induced thyroid changes are physiological and essential for fetal development. Regular thyroid assessment during pregnancy is crucial to prevent maternal and fetal complications.


## Introduction

The thyroid gland plays a critical role in maintaining metabolic balance, regulating heart rate, supporting neural functions, and ensuring optimal protein and lipid metabolism. During pregnancy, the maternal metabolic demand increases significantly, leading to corresponding changes in thyroid physiology.

Thyroid hormones—T3 and T4—are essential for fetal neural and skeletal development. In early pregnancy, the fetus is entirely dependent on the maternal thyroid hormones because the fetal thyroid becomes functional only after the end of the first trimester (around 12–14 weeks). Therefore, any maternal thyroid dysfunction may lead to adverse outcomes such as preeclampsia, spontaneous abortion, anemia, placental abnormalities, low birth weight, and intellectual disabilities in the newborn.

Several pregnancy-related hormones influence thyroid function:

1. Human chorionic gonadotropin (HCG)
   - Structurally similar to TSH
   - Stimulates thyroid hormone production
   - Suppresses TSH levels
2. Estrogen
   - Increases thyroid-binding globulin (TBG)
   - Total T3 and T4 levels increase
3. Physiological increase in renal iodine clearance
   - Higher iodine requirement

Due to these changes, normal non-pregnant thyroid ranges cannot be applied to pregnant women. This study compares thyroid hormone levels in pregnant and non-pregnant women and highlights the physiological differences.

## Review of Literature

1. Glinoer et al.

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Reported that HCG causes mild hyperthyroid-like stimulation in the first trimester, leading to increased T4 and decreased TSH.

2. Haddow et al.

Demonstrated that low maternal thyroid hormone levels are linked to a reduction of 7–10 IQ points in children.

3. Zimmermann et al.

Found that iodine deficiency during pregnancy leads to maternal hypothyroxinemia and impaired fetal development.

4. Stagnaro-Green et al.

Proposed trimester-specific TSH reference ranges for accurate thyroid assessment in pregnancy.

5. Krassas et al.

Established that pregnancy physiologically increases total T3 and T4 due to increased TBG synthesis.

6. Alexander et al.

Showed that untreated maternal hypothyroidism significantly increases the risk of miscarriage and preterm birth.

7. Negro et al.

Demonstrated that levothyroxine therapy in hypothyroid pregnant women reduces obstetric complications.

These studies support that thyroid physiology changes markedly during pregnancy and should be interpreted cautiously.

# Materials and Methods

Study Design

Comparative cross-sectional observational study.

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Sample Size 100 women

- Pregnant women (n = 50)
- Non-pregnant healthy women (n = 50)

Age Group 20–40 years.

Inclusion Criteria

- Healthy pregnant women (1st or 2nd trimester)
- Healthy non-pregnant women
- No known thyroid disease

Exclusion Criteria

- Known thyroid disorder
- Diabetes, hypertension, or autoimmune disease
- Medications affecting thyroid function (e.g., steroids, antithyroid drugs)
- Iodine deficiency disorders

Sample Collection

- 5 mL venous blood collected in plain vials
- Serum separated by centrifugation
- Analysis performed by Chemiluminescence Immunoassay (CLIA)

Parameters Measured

- Serum T3
- Serum T4
- Serum TSH

Statistical Analysis

- Mean ± Standard Deviation
- T-test used for comparison
- $P < 0.05$ considered statistically significant

## Results

This study compared thyroid hormone levels among 100 women, including 50 pregnant and 50 non-pregnant participants. The analysis shows a marked increase in T3 and T4 levels in pregnant women due to physiological stimulation of the thyroid gland by HCG. Mean T3 levels were significantly higher in pregnant women (190 mg/dL) compared to non-pregnant controls (120 mg/dL). Similarly, T4 levels showed a substantial increase in the pregnant group (12.5 µg/dL) compared to controls (8.2 µg/dL). In contrast, mean TSH levels were found to be significantly lower in pregnant women (1.10 mIU/L) than in non-pregnant women (2.80 mIU/L), which aligns with the expected suppression of TSH during pregnancy. These findings clearly demonstrate characteristic thyroid adaptations required to maintain pregnancy and support fetal development.

The graphs included below illustrate the comparative trends of T3, T4, and TSH levels between both groups, providing a clearer visual representation of hormonal changes.

Table: Comparison of Thyroid Hormones

| Group | T3 (mg/dL) | T4 (µg/dL) | TSH (mIU/L) |
|---|---|---|---|
| Pregnant (n=50) | 190 | 12.5 | 1.1 |
| Non-Pregnant (n=50) | 120 | 8.2 | 2.8 |

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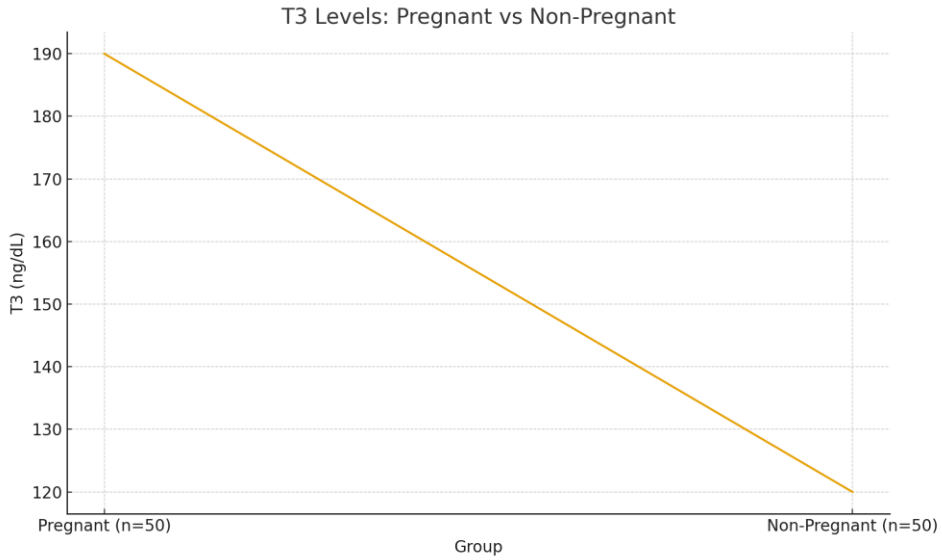
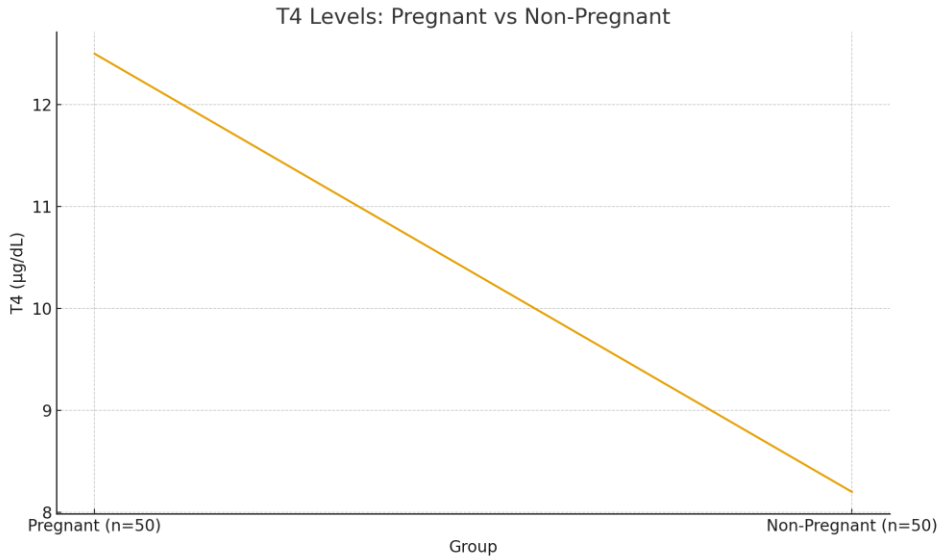
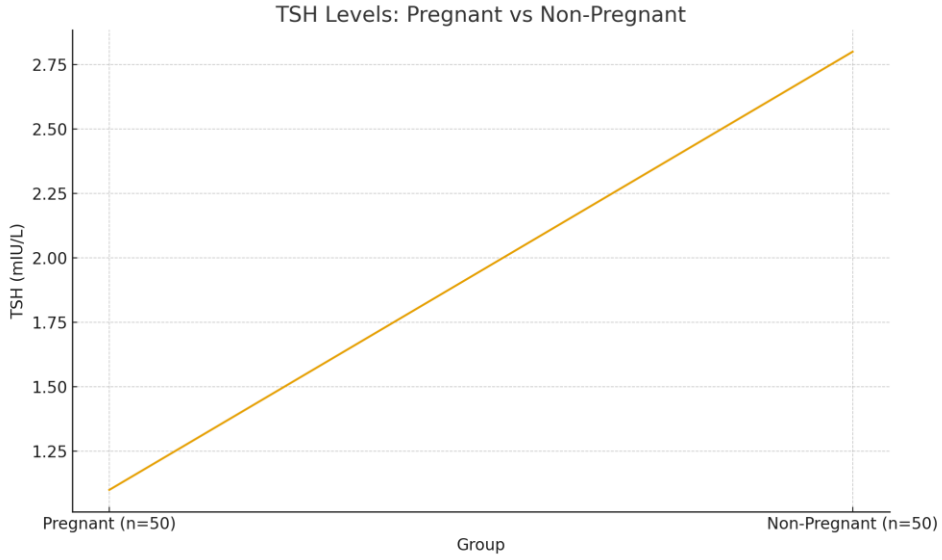
Graph: T3 Levels




Graph: T4 Levels




Graph: TSH Levels



## Discussion

The results of the present study strongly support existing scientific literature regarding pregnancy-related thyroid physiology. The elevated levels of T3 and T4 are attributed to:

- HCG acting as a natural thyroid stimulator
- Estrogen-induced increase in TBG
- Higher metabolic demand during pregnancy

Simultaneously, the reduced TSH levels indicate feedback inhibition caused by elevated thyroid hormones.

Clinical Importance

- Low maternal thyroid hormones may impair fetal mental and physical development.
- Hyperthyroidism may lead to miscarriage, placental abruption, and fetal loss.
- Mild TSH suppression in pregnancy is normal and should not be misdiagnosed.

Need for Trimester-Specific Ranges

Non-pregnant reference intervals are inappropriate for pregnant women.

Using incorrect ranges may lead to:

- Over diagnosis of hyperthyroidism
- Underdiagnoses of hypothyroidism

## CONCLUSION

This study concludes that pregnancy leads to significant physiological changes in thyroid function. The pregnant group demonstrated:

- Higher T3 and T4 levels
- Lower TSH levels

These changes are essential for maintaining pregnancy and supporting fetal development. Therefore, routine thyroid screening during pregnancy is strongly recommended to avoid adverse maternal and fetal outcomes.

REFERENCES

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