

Occurrence of Hypothyroidism in Infertile Women and Evaluation of Response to Treatment in Infertility

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Abstract

Background: Infertility is a major reproductive health problem globally affecting about 10–15% of couples and has important psychological, social and economic consequences. Thyroid dysfunction -- particularly hypothyroidism -- has become a focus of attention among the endocrine causes of infertility, as it affects ovulation, menstrual regularity, implantation and maintenance of pregnancy. Both overt and subclinical hypothyroidism are potentially reversible causes of infertility, and early diagnosis and treatment is of clinical importance. The objective is to assess the prevalence of hypothyroidism in women with infertility and to evaluate the response to treatment of hypothyroidism in infertility. **Material and Methods:** Between October 2024 and September 2025, the Department of Obstetrics and Gynaecology at Gauhati Medical College and Hospital in Assam conducted prospective observational research. One hundred infertile ladies were enlisted. Serum levels of free thyroxine (FT4), free triiodothyronine (FT3), and thyroid-stimulating hormone (TSH) were measured to evaluate thyroid function. Subjects were classified into groups: euthyroid, subclinical hypothyroid, and overt hypothyroid. Women with hypothyroidism were treated with levothyroxine and prospectively followed to assess changes in thyroid function and reproductive outcomes. Appropriate tests were used for statistical analysis, and a p-value of less than 0.05 was deemed statistically significant. **Results:** Thyroid dysfunction was present in 46% of the 100 infertile women, with 54% being euthyroid, 33% having subclinical hypothyroidism, and 13% having overt hypothyroidism. The majority of the ladies were between the ages of 31 and 35. Age, body mass index, menstruation pattern, parity, history of abortion, and family history of thyroid disease did not significantly correlate with thyroid function. Serum TSH levels were significantly decreased ($p < 0.001$) after levothyroxine therapy. The conception rate was 51% and a significant association was found between the conception outcome and the thyroid status ($p = 0.032$). Most conceptions occurred 2–7 months after the start of treatment. **Conclusion:** Hypothyroidism is a common and reversible cause of infertility in infertile women, especially subclinical hypothyroidism. Routine thyroid screening and prompt levothyroxine therapy can greatly improve reproductive outcomes and should be part of infertility evaluation.

Keywords: Infertility; Hypothyroidism; Subclinical Hypothyroidism; Levothyroxine; Thyroid Dysfunction; Conception Outcome; Female Infertility.

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INTRODUCTION

Millions of couples worldwide struggle with infertility, which has become a significant public health issue. The World Health Organization defines infertility as the inability to conceive after 12 months or more of consistent, unprotected sexual activity.^[1] Globally, infertility affects an estimated 48–50 million couples, with prevalence rates from 8% to 15% depending on geographic region and population characteristics.^[2] Infertility is a major psychological, social, cultural and economic burden in developing countries like India, especially on women who bear the brunt of social stigma of childlessness.^[3]

Infertility is multifactorial and may be due to female, male, combined or unexplained factors. Infertility in women is often caused by ovulatory disorders, tubal disease, uterine abnormalities, endometriosis, and endocrine dysfunction.^[4] Thyroid dysfunction is one of the most important endocrine disorders, as thyroid hormones are critical for the maintenance of normal reproductive physiology. The thyroid

gland plays a role in the hypothalamic–pituitary–ovarian axis and regulates ovarian steroidogenesis, folliculogenesis, ovulation, implantation and early embryonic development, thus influencing various aspects of female reproductive function.^[5]

Thyroid hormones (thyroxine, T4 and triiodothyronine, T3) act through nuclear receptors in ovarian granulosa cells, endometrial tissue and trophoblastic cells. Thus, normal reproductive performance requires adequate levels of thyroid hormones.^[6] Even subtle changes in thyroid function can adversely influence

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fertility and disturb reproductive endocrinology. Hypothyroidism, a condition where the thyroid gland does not generate enough thyroid hormone, is one of the most prevalent endocrine disorders in women of reproductive age.^[7]

Hypothyroidism is categorised into overt hypothyroidism and subclinical hypothyroidism. Overt hypothyroidism is characterised by heightened serum thyroid-stimulating hormone (TSH) concentrations and diminished free thyroxine levels, whereas subclinical hypothyroidism is marked by raised TSH levels with normal thyroid hormone levels in circulation.^[8] Overt hypothyroidism is easily recognized by its clinical manifestations, but subclinical hypothyroidism is often asymptomatic and may be missed unless routine thyroid function testing is performed.^[9]

The link between hypothyroidism and infertility is mediated by several physiological mechanisms. The hypothalamus secretes more thyrotropin-releasing hormone (TRH) when thyroid hormone levels are low. Prolactin is secreted by the anterior pituitary gland in response to TRH stimulation. Then, hyperprolactinemia prevents gonadotropin-releasing hormone from being secreted, which leads to aberrant luteinizing hormone (LH) and follicle-stimulating hormone (FSH) secretion, anovulation, irregular menstruation, and infertility.^[10] Additionally, low levels of sex hormone binding globulin, altered oestrogen metabolism, luteal phase abnormalities, poor follicular growth, and lower endometrial receptivity are linked to hypothyroidism.^[11]

An increased prevalence of thyroid dysfunction in infertile women compared with fertile controls has been demonstrated by a number of investigators. In infertile women, Arojoki et al. reported high TSH levels,^[12] and Abalovich et al. found an increased prevalence of subclinical hypothyroidism among women with infertility.^[13] Studies from India have also demonstrated a significant burden of thyroid dysfunction among infertile women, with prevalence ranging from 23% to over 50%.^[14,15] The high prevalence of subclinical hypothyroidism in these studies indicates that a considerable number of infertile women may have occult thyroid dysfunction that may negatively impact reproductive outcomes.

Thyroid dysfunction has important implications for assisted reproductive technologies (ART) and impact on natural fertility. Increased TSH levels have been associated with decreased ovarian responsiveness, decreased implantation rate, increased miscarriage rate and poor pregnancy outcomes in women undergoing in vitro fertilization and intracytoplasmic sperm injection procedures.^[16] Thus, several professional societies including the American Thyroid Association endorse routine thyroid function assessment in the evaluation of infertility and recommend maintaining serum TSH concentrations < 2.5 mIU/L in women trying to conceive.^[17]

One of the most important clinical features of hypothyroidism is that, for the most part, it is reversible with appropriate treatment. Levothyroxine replacement therapy has been shown to restore euthyroid status and improve ovulatory function, menstrual regularity, endometrial receptivity, and pregnancy outcomes.^[18] Previous studies

have noted better conception rates after correction of thyroid dysfunction, especially in women with subclinical hypothyroidism.^[14,15] Early diagnosis and treatment may prevent unnecessary investigations and reduce the requirement for more advanced fertility interventions.

Though the association between thyroid dysfunction and infertility is being increasingly recognized, regional data from Northeast India are still sparse. Differences in iodine intake, environmental factors, genetic predisposition and availability of health care may influence the incidence and clinical presentation of hypothyroidism in infertile women. Thus, data from individual regions are needed to determine the extent of the problem and to assess the results of treatment in the local population.

In light of these facts, the current study was carried out to determine the prevalence of hypothyroidism among infertile women visiting a tertiary care facility as well as the effectiveness of levothyroxine therapy in enhancing reproductive outcomes. As a crucial component of the assessment and treatment of infertility, the results of this study may support recommendations for regular thyroid monitoring and prompt management of thyroid dysfunction.

MATERIALS AND METHODS

Study Design: In order to determine the prevalence of hypothyroidism in infertile women and the effectiveness of treatment for hypothyroidism in infertility, a prospective observational study was carried out in a hospital.

Study Setting: The study was conducted in the Department of Obstetrics and Gynaecology, Gauhati Medical College and Hospital (GMCH), Guwahati, Assam, a tertiary care center catering to patients from Assam and neighboring states of Northeast India.

Study Duration: The study was carried out over a period of one year from 1 October 2024 to 30 September 2025.

Study Population: Women attending the infertility clinic of the Department of Obstetrics and Gynaecology during the study period were screened for eligibility and enrolled after obtaining informed written consent.

Sample Size

The sample size was calculated using the formula:

$$n = \frac{4PQ}{L^2}$$

Where:

- P = Expected prevalence of hypothyroidism among infertile women
- Q = 100 – P
- L = Allowable error

The minimum computed sample size was 96 based on prior prevalence estimates published in the literature. The study recruited 100 infertile women in order to boost statistical validity and account for any dropouts.

Inclusion Criteria

Women fulfilling all of the following criteria were included:

- Women diagnosed with infertility.
- Failure to conceive despite one year of regular unprotected

sexual intercourse.

- Women willing to participate in the study.
- Women providing informed written consent.

Exclusion Criteria

The following women were excluded from the study:

- Women with known tubal factor infertility.
- Women with diagnosed polycystic ovarian syndrome (PCOS).
- Women with congenital uterine anomalies.
- Women with confirmed male factor infertility.
- Pregnant women.
- Women currently receiving thyroid hormone replacement therapy.
- Women unwilling to participate in the study.

Ethical Considerations: The research protocol received scrutiny and endorsement from the Institutional Ethics Committee of Gauhati Medical College and Hospital prior to the initiation of the investigation. All participants were informed regarding the purpose of the study, procedures involved, potential benefits, and confidentiality of collected data. Prior to enrolment, written consent was acquired from all participants. The investigation was carried out in compliance with the ethical guidelines specified in the Declaration of Helsinki.^[19]

Study Procedure: Eligible participants attending the infertility clinic were recruited consecutively during the study period.

Clinical Evaluation

A detailed history was obtained from each participant regarding:

- Age
- Duration of infertility
- Type of infertility (primary or secondary)
- Menstrual history
- Obstetric history
- Previous abortions
- Family history of thyroid disease
- Previous medical illnesses
- Medication history

A comprehensive general physical examination and systemic examination were performed.

Particular attention was given to identifying clinical features suggestive of hypothyroidism such as:

- Weight gain
- Cold intolerance
- Decreased appetite
- Goitre
- Menstrual disturbances

Anthropometric Measurements

Height and weight were recorded using standardized methods.

Body Mass Index (BMI) was calculated using the formula:

$$BMI = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

Participants were categorized according to World Health Organization BMI classifications:^[20]

- Underweight: <18.5 kg/m²
- Normal weight: 18.5–24.9 kg/m²
- Overweight: 25.0–29.9 kg/m²
- Obese: ≥30 kg/m²

Laboratory Evaluation

All participants underwent thyroid function testing.

The following biochemical parameters were measured:

Thyroid-Stimulating Hormone (TSH)

Serum TSH concentration was estimated using standardized immunoassay techniques.

Free Thyroxine (FT4)

Serum free thyroxine levels were measured to assess thyroid hormone status.

Free Triiodothyronine (FT3)

Serum FT3 concentrations were determined where indicated.

Anti-Thyroid Peroxidase Antibodies (Anti-TPO)

Anti-TPO antibody levels were assessed to evaluate autoimmune thyroid disease.

Classification of Thyroid Status

Subjects were categorised into three groups according to the outcomes of thyroid function assessments.

Euthyroid Group

Women with normal serum TSH and FT4 levels.

Subclinical Hypothyroidism Group

Women with elevated TSH levels and normal FT4 concentrations.

Overt Hypothyroidism Group

Women with elevated TSH levels accompanied by reduced FT4 concentrations.

Treatment Protocol

All women diagnosed with overt or subclinical hypothyroidism were started on levothyroxine therapy according to standard treatment recommendations.^[17]

The initial dose of levothyroxine was individualized based on:

- Baseline TSH level
- Severity of hypothyroidism
- Clinical condition
- Body weight

Patients were counseled regarding proper medication intake and adherence.

Follow-Up: Women receiving levothyroxine therapy were followed up periodically.

During follow-up, the following parameters were assessed:

- Changes in thyroid function tests.
 - Improvement in menstrual cycle regularity.
 - Improvement in menstrual flow pattern.
 - Achievement of conception.
 - Time interval between initiation of treatment and conception.
- Repeat thyroid function tests were performed after six weeks of therapy to assess biochemical response.

Outcome Measures

Primary Outcome

- Occurrence of hypothyroidism among infertile women.

Secondary Outcomes

- Improvement in thyroid profile following levothyroxine therapy.
- Improvement in menstrual pattern.
- Conception following treatment.
- Time interval between treatment initiation and conception.

Statistical Analysis: Data were inputted into Microsoft Excel and examined utilising Statistical Package for the Social Sciences (SPSS) software.

Continuous variables were represented as mean $\pm$ standard deviation (SD).

Categorical variables were represented as counts and proportions.

The following statistical tests were applied:

- Chi-square test for comparison of categorical variables.
- Analysis of variance (ANOVA) for comparison of quantitative variables among groups.
- Paired comparisons for evaluation of pre-treatment and post-treatment thyroid parameters.

A p-value less than 0.05 was considered statistically significant.

Operational Definitions

Primary Infertility

Inability to get pregnancy after one year of consistent unprotected sexual activity in a woman with no prior conception history.^[1]

Secondary Infertility

Inability to attain pregnancy after one year of consistent unprotected coitus in a woman who has previously conceived

at least once, regardless of the result of that pregnancy.^[12]

Conception Outcome

Achievement of clinically confirmed pregnancy during the follow-up period after initiation of treatment.

Response to Treatment

Response to treatment was defined by:

- Reduction in serum TSH levels,
- Restoration of euthyroid status,
- Improvement in menstrual regularity,
- Successful conception during follow-up.

RESULTS

Baseline Characteristics of the Study Population: A total of 100 infertile women were enrolled in the study and evaluated for thyroid dysfunction. The age of participants ranged from 20 to more than 40 years, with the highest proportion belonging to the 31–35-year age group (34%), followed by the 26–30-year age group (29%). Women aged 20–25 years and 36–40 years each constituted 17% of the study population, whereas only 3% were older than 40 years. The majority of participants had normal body mass index (53%), while 39% were overweight, 5% were obese, and 3% were underweight.

Table 1: Distribution of Participants According to Age Group (n = 100)

Age Group (Years)	Frequency	Percentage (%)
20–25	17	17.0
26–30	29	29.0
31–35	34	34.0
36–40	17	17.0
>40	3	3.0
Total	100	100.0

The predominant segment of infertile women was within the 31–35-year age bracket, accounting for one-third of the research cohort. This finding reflects the increasing trend of

delayed conception and infertility evaluation among women in their early thirties.

Table 2: Distribution According to BMI Category (n = 100)

BMI Category	Frequency	Percentage (%)
Underweight	3	3.0
Normal	53	53.0
Overweight	39	39.0
Obese	5	5.0
Total	100	100.0

More than half of the participants had normal BMI, while approximately two-fifths were overweight. Obesity was relatively uncommon. These findings indicate that infertility and thyroid dysfunction occurred across a broad spectrum of body weight categories.

Thyroid Status Distribution: Out of 100 infertile women

examined, 54% were classified as euthyroid, 33% were identified with subclinical hypothyroidism, and 13% were diagnosed with overt hypothyroidism. As a result, thyroid dysfunction was identified in 46% of the participants in the study.

Table 3: Distribution of Thyroid Status Among Study Participants (n = 100)

Thyroid Status	Frequency	Percentage (%)
Euthyroid	54	54.0
Subclinical Hypothyroidism	33	33.0
Overt Hypothyroidism	13	13.0
Total	100	100.0

Almost fifty percent of the women experiencing infertility displayed thyroid abnormalities. Subclinical hypothyroidism

represented the predominant anomaly, including over two-thirds of all diagnosed thyroid conditions.

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Figure 1: Distribution of Thyroid Status

association between age category and thyroid condition was examined utilising the Chi-square test.

Association Between Age Group and Thyroid Status: The

Table 4: Association Between Age Group and Thyroid Status

Variable	χ^2	df	p-value
Age Group vs Thyroid Status	6.743	8	0.565

No statistically significant association was observed between age group and thyroid status ($p = 0.565$). Thyroid dysfunction occurred across all reproductive age groups, indicating that

age alone cannot predict thyroid abnormalities among infertile women.

Association Between BMI and Thyroid Status

Table 5: Association Between BMI Category and Thyroid Status

Variable	χ^2	df	p-value
BMI Category vs Thyroid Status	2.867	6	0.825

No statistically significant relationship was identified between BMI category and thyroid status ($p = 0.825$). Thyroid dysfunction was observed among women with normal, overweight, obese, and underweight BMI categories.

Clinical Characteristics: The majority of subjects (87%)

did not display clinical indicators indicative of hypothyroidism. A minor fraction of individuals indicated a diminished appetite (5%), weight increase (3%), goitre (3%), cold sensitivity (1%), or a combination of cold sensitivity with reduced hunger (1%).

Table 6: Clinical Findings Among Study Participants

Clinical Finding	Percentage (%)
No Clinical Finding	87
Decreased Appetite	5
Goitre	3
Weight Gain	3
Cold Intolerance	1
Cold Intolerance + Decreased Appetite	1

The majority of women with thyroid dysfunction lacked overt clinical manifestations, emphasizing the importance of biochemical screening rather than relying solely on symptoms

Menstrual Characteristics: A total of 66% of women had stable menstrual periods, in contrast to 34% who reported

irregularities. A statistically significant relationship was not found between the patterns of the menstrual cycle and thyroid health ($\chi^2 = 1.467$, $p = 0.480$). Correspondingly, the monthly flow pattern revealed no significant relationship with thyroid function ($\chi^2 = 5.012$, $p = 0.286$).

Table 7: Menstrual Characteristics and Thyroid Status

Variable	χ^2	df	p-value
Menstrual Cycle Pattern	1.467	2	0.480
Menstrual Flow Pattern	5.012	4	0.286

While some subjects experienced menstrual anomalies, the current investigation found no statistically significant association between thyroid disease and menstrual patterns.

Parity and Previous Abortions: Sixty-seven percent of the individuals were nulliparous, and thirty-three percent were

multiparous. There was no discernible correlation between thyroid status and parity ($p = 0.484$). Thyroid dysfunction was also not significantly correlated with prior abortion history ($p = 0.738$).

Table 8: Association of Parity and Abortion History with Thyroid Status

Variable	χ^2	df	p-value
Parity vs Thyroid Status	1.450	2	0.484
Previous Abortions vs Thyroid Status	1.989	4	0.738

Neither parity nor previous abortion history demonstrated a statistically significant relationship with thyroid dysfunction among infertile women.

Thyroid Profile Comparison: A highly significant

difference was observed in biochemical thyroid parameters among euthyroid, subclinical hypothyroid, and overt hypothyroid groups.

Table 9: Thyroid Profile Comparison Among Thyroid Status Groups

Parameter	Euthyroid (Mean $\pm$ SD)	Subclinical Hypothyroidism (Mean $\pm$ SD)	Overt Hypothyroidism (Mean $\pm$ SD)	p-value
TSH (mIU/L)	2.74 $\pm$ 1.06	13.36 $\pm$ 4.62	27.59 $\pm$ 3.87	<0.001

Serum TSH levels increased progressively from euthyroid to overt hypothyroid groups, confirming the biochemical classification of thyroid dysfunction and demonstrating a highly significant difference between groups.

Conception Outcome: A total of 51 women conceived

during follow-up, whereas 49 did not conceive. A statistically significant association was found between conception outcome and thyroid status ($\chi^2 = 6.890$, $p = 0.032$).

Table 10: Association Between Conception Outcome and Thyroid Status

Thyroid Status	Conceived n (%)	Not Conceived n (%)
Euthyroid	24 (44.5)	30 (55.5)
Overt Hypothyroidism	11 (84.6)	2 (15.4)
Subclinical Hypothyroidism	16 (48.48)	17 (51.52)

$\chi^2 = 6.890$, $df = 2$, $p = 0.032$

Conception outcomes differed significantly among thyroid status groups. The highest conception rate was observed among treated overt hypothyroid women, demonstrating the beneficial effect of levothyroxine therapy and restoration of

euthyroid status.

Effect of Levothyroxine Therapy on TSH Levels: A significant reduction in serum TSH levels was observed after six weeks of levothyroxine therapy.

Table 11: Baseline and Six-Week Follow-Up TSH Levels

Group	Baseline TSH (mIU/L)	Follow-Up TSH (mIU/L)
Euthyroid	2.74	1.52
Subclinical Hypothyroidism	13.36	7.23
Overt Hypothyroidism	27.59	15.58

$p < 0.001$

Levothyroxine therapy resulted in a marked decline in serum TSH levels across hypothyroid groups, confirming effective biochemical response to treatment within six weeks.

Figure 2: Reduction in TSH Following Levothyroxine Therapy

DISCUSSION

The purpose of the current prospective observational study was to determine whether hypothyroidism affects infertile women and whether levothyroxine medication improves fertility results. Thyroid dysfunction was shown to be highly prevalent in infertile women. In fact, 46% of the women had some form of hypothyroidism. Subclinical hypothyroidism was the commonest (33%) and overt hypothyroidism was 13% of these. These findings underline the important role of thyroid dysfunction as a potentially reversible endocrine cause of infertility and support the inclusion of thyroid screening in the routine infertility evaluation.

Thyroid Function and Age Distribution: In the present study, highest percentage of infertile women was found in age group of 31-35 years (34%) followed by 26-30 years (29%). However, there was no statistically significant correlation ($p = 0.565$) between thyroid health and age. These results suggest that thyroid dysfunction is not age-dependent and can develop across the reproductive age range.

Similar findings have been reported by Arojoki et al who found higher TSH levels among infertile women without identifying age as a major determinant of thyroid dysfunction.^[21] Similarly, Abalovich et al. reported a higher prevalence of subclinical hypothyroidism among infertile women but did not demonstrate a significant age-related association.^[22] Verma et al also concluded that routine screening of thyroid should be done irrespective of age as hypothyroidism can occur throughout reproductive years.^[23]

The finding of no age-related variation in thyroid dysfunction in the current study supports the need for universal screening strategies rather than selective testing based on maternal age alone.

Thyroid function and body mass index: Body mass index is often regarded as an important factor affecting both thyroid function and fertility. This study found that 53% of the individuals had a normal BMI, 39% were classified as overweight, 5% were identified as obese, and 3% were categorised as underweight. No substantial link was established between BMI group and thyroid health ($p = 0.825$).

Our results contradict the study of Pushpagiri et al., which indicated that 91.4% of infertile women with hypothyroidism were obese and identified a strong correlation between obesity and thyroid malfunction.^[24] On the other hand, Awan et al. reported high prevalence of hypothyroidism among infertile women, but they did not find BMI as an independent determinant of thyroid status.^[25]

The difference in the results of the studies may be due to the differences in dietary habits, genetic factors, regional factors and sample size. These findings show that thyroid dysfunction may arise irrespective of body weight and hence BMI should not be used to determine which infertile women require thyroid investigation.

Prevalence of thyroid disease: One of the most important findings of the present study was the high prevalence of thyroid dysfunction. In a study of 100 infertile women, 46% were found to have thyroid dysfunction including 33% subclinical hypothyroidism and 13% overt hypothyroidism.

These outcomes are in agreement with other earlier investigations that have documented a significant association between thyroid disease and infertility. According to Abalovich et al., 13.9% of infertile women exhibited subclinical hypothyroidism [22]. Arojoki et al. indicated that 4% of infertile women exhibited heightened TSH levels [21]. According to

Verma et al., 23.9% of infertile women were found to have hypothyroidism.^[23] Pushpagiri et al documented hypothyroidism in 27% of infertile women out of which 25% had subclinical disease.^[24]

Higher prevalence rates with hypothyroidism detected in 53.7% of infertile women have also been reported by Priya et al.^[26] Thyroid dysfunction has been documented in 63.1% of infertile women by Awan et al.^[25]

The prevalence in the present study is in line with the previous literature and further supports the fact that hypothyroidism, especially subclinical hypothyroidism is a common endocrine abnormality in the infertile women. The relevance of subclinical sickness lies in the fact that women may remain asymptomatic while facing diminished fertility.

Clinical Features and Menstrual Pattern: The majority of the participants (87%) had no obvious clinical manifestations of thyroid dysfunction. A small proportion reported decreased appetite, goitre, weight gain or cold intolerance. Also, thyroid status was not significantly associated with menstrual cycle pattern ($p = 0.480$) and menstrual flow pattern ($p = 0.286$).

Hypothyroidism has traditionally been associated with menstrual disturbances such as oligomenorrhea, polymenorrhea, menorrhagia and amenorrhea.^[27] However, the present study suggests that many infertile women with thyroid dysfunction may not have clinically evident menstrual disturbances. The finding highlights the limitations of a diagnosis based solely on symptoms and supports routine biochemical screening.

The notable frequency of asymptomatic thyroid malfunction revealed in our study is especially significant for subclinical hypothyroidism, which typically eludes detection until an infertility assessment is performed.

Abortion History, Parity and Family History: There was no statistically significant association between thyroid status and parity ($p = 0.484$), previous abortions ($p = 0.738$) or family history of thyroid disease ($p = 0.775$).

Pushpagiri et al. also found negative relation between hypothyroidism and family history of thyroid disease.^[24]

Although the rates of thyroid dysfunction were numerically higher in women with repeated abortions, the association was not statistically significant.

These results suggest that thyroid dysfunction may be present even in the absence of traditional risk factors. Hence, thyroid function tests should be incorporated in protocols of infertility evaluation irrespective of parity status, reproductive or family history.

Biochemical and Thyroid Profile Results: There was a highly significant difference in thyroid hormone profiles between euthyroid, subclinical hypothyroid and overt hypothyroid groups. Mean serum TSH levels rose progressively from 2.74 ± 1.06 mIU/L in euthyroid women to 13.36 ± 4.62 mIU/L in subclinical hypothyroidism and 27.59 ± 3.87 mIU/L in overt hypothyroidism ($p < 0.001$).

These findings are in keeping with the known pathophysiology of hypothyroidism. A heightened TSH concentration suggests that the pituitary gland is intensifying its activity to counterbalance the thyroid gland's reduced production of thyroid hormones. Thyroid hormone

deficiency adversely affects reproductive physiology by alterations in gonadotropin secretion, follicular development, luteal function and endometrial receptivity.^[5,10]

The biochemical abnormalities in this study provide good evidence in support of the role of thyroid dysfunction as an endocrine factor in the etiology of infertility.

Levothyroxine Therapy Response: Evaluating response to levothyroxine treatment was an important goal of the study. Serum TSH levels were significantly decreased after six weeks of therapy ($p < 0.001$). In women with subclinical hypothyroidism, the mean TSH level decreased from 13.36 to 7.23 mIU/L, and in women with overt hypothyroidism, it decreased from 27.59 to 15.58 mIU/L.

These findings align with the observations made by Rahman et al., who noted considerable normalisation of TSH following levothyroxine treatment.^[28] Comparable enhancements have been documented by Verma et al.,^[23] Priya et al.,^[26] and Awan et al.^[25]

The observed biochemical response confirms the efficacy of the levothyroxine therapy to bring back to the euthyroid state and emphasises its importance as a first line intervention for infertile women with thyroid dysfunction.

Result of Fertility Enhancement & Conception: A key therapeutically pertinent discovery of this study was the notable correlation between thyroid function and conception outcomes ($p = 0.032$). Overall, 51% of the participants became pregnant during the follow-up period. 48.48% of the women with subclinical hypothyroidism conceived after treatment and 84.6% of the women with overt hypothyroidism conceived after treatment with levothyroxine.

These findings align with previous research indicating enhanced pregnancy results following the rectification of thyroid abnormalities. Verma et al.,^[23] documented a pregnancy rate of 76.6% among women with hypothyroidism who received treatment. Priya et al.,^[26] discovered that 33.3% of women with subclinical hypothyroidism achieved pregnancy after treatment. Awan et al. indicated that following therapy, 60% of women with overt hypothyroidism and 73.1% of those with subclinical hypothyroidism had the resumption of ovulation.^[25]

The dramatic increase in conception rates observed in this study suggests the reversible nature of hypothyroidism-associated infertility. Early diagnosis and treatment therefore could improve fertility without the need for costly assisted reproductive procedures.

Time Interval from Treatment to Conception: Most conceptions occurred 2–7 months after initiation of levothyroxine therapy. However, there was no meaningful relationship between thyroid function and the time to achieve conception ($p = 0.787$).

These results suggest that correction of thyroid dysfunction improves fertility, but the exact timing of conception is probably influenced by other reproductive, hormonal and environmental factors. Similar observations have been reported in previous studies assessing fertility outcomes following thyroid hormone replacement therapy.^[23,26]

CONCLUSION

The current research aimed to investigate the prevalence of

hypothyroidism in women experiencing infertility and to examine the effects of levothyroxine treatment on enhancing fertility results. The results indicated that thyroid abnormalities were observed in 46% of women experiencing infertility, with subclinical hypothyroidism representing 33% and overt hypothyroidism constituting 13% of the instances. These results demonstrate that hypothyroidism is a common endocrine abnormality among women presenting with infertility and that subclinical disease constitutes the predominant form.

No significant statistical relationship was found between thyroid function and age, body mass index, number of births, menstruation regularity, abortion history, infertility type, or family history of thyroid disorders. These conclusions imply that thyroid dysfunction can manifest independently of baseline demographic or clinical attributes, making it impossible to predict reliably based on clinical assessments alone.

A highly significant reduction in serum TSH levels was observed following levothyroxine therapy ($p < 0.001$), confirming the effectiveness of thyroid hormone replacement in restoring euthyroid status. Additionally, conception was observed in 51% of the subjects, and a statistically significant correlation was found between thyroid status and conception results ($p = 0.032$). The majority of pregnancies transpired within 2 to 7 months following the commencement of treatment.

The findings of the present study reinforce the concept that hypothyroidism, particularly subclinical hypothyroidism, is a potentially reversible cause of infertility. Early diagnosis and timely treatment with levothyroxine can significantly improve reproductive outcomes and may reduce the need for expensive assisted reproductive interventions. Routine thyroid assessment should thus be regarded as a crucial element of infertility analysis.

Strengths of the Study

1. Prospective observational study design with systematic follow-up.
2. Evaluation of both overt and subclinical hypothyroidism in infertile women.
3. Assessment of biochemical response following levothyroxine therapy.
4. Evaluation of clinically relevant reproductive outcomes, including conception rates.
5. Conducted at a tertiary care referral center catering to a diverse population.
6. Provides important regional data regarding thyroid dysfunction among infertile women in Northeast India.
7. Included assessment of multiple demographic, clinical, biochemical, and reproductive variables.

Limitations of the Study

1. Relatively small sample size of 100 participants.
2. Single-center investigation, potentially constraining the applicability of results.
3. Follow-up period was limited and may not have captured all long-term reproductive outcomes.
4. Live birth rates and pregnancy complications were not evaluated.
5. Thyroid autoimmunity could not be comprehensively

assessed in all participants.

6. Lack of a fertile control group for direct comparison.
7. Other subtle infertility factors may have influenced conception outcomes.

Clinical Implications

The findings of the present study have important implications for infertility management:

1. Thyroid function testing should be routinely incorporated into infertility workup.
2. Subclinical hypothyroidism should not be overlooked because of its high prevalence and adverse reproductive effects.
3. Early initiation of levothyroxine therapy can improve thyroid function and fertility outcomes.
4. Universal thyroid screening may be more beneficial than selective screening based on symptoms or risk factors.
5. Correction of thyroid dysfunction before assisted reproductive procedures may improve treatment success rates.
6. Regular monitoring of thyroid function should be undertaken during preconception counseling and fertility treatment.

Recommendations

1. Routine thyroid screening should be included in all infertility evaluation protocols.
2. Larger multicentric studies are required to determine the true burden of thyroid dysfunction among infertile women in India.
3. Long-term follow-up studies should evaluate live birth rates and neonatal outcomes after thyroid correction.
4. Further studies are needed to explore the role of thyroid autoimmunity in infertility.
5. Public awareness regarding the impact of thyroid disorders on fertility should be enhanced.

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Conflicts of interest

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