

Changes In Thyroid Status Of Women In An Iodine Deficiency Disorder Region

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Abstract

Iodine deficiency remains a leading cause of thyroid dysfunction worldwide, particularly among women of reproductive age. Chronic iodine insufficiency disrupts thyroid hormone synthesis, resulting in hypothyroidism and other thyroid-related disorders. This study aimed to determine the changes in thyroid status of women in an iodine deficiency disorder region.

A retrospective descriptive study was conducted using medical records of 200 women who attended the Jos University Teaching Hospital, Plateau State, Nigeria, between January 2020 and December 2024. Data on serum thyroid-stimulating hormone (TSH) and thyroxine (T4) levels were retrieved from the hospital's electronic database. Thyroid status was categorized as hypothyroid or non-hypothyroid based on standard reference ranges. Descriptive statistics summarized the data, and chi-square tests evaluated associations, with significance set at $p < 0.05$.

Among the 200 participants, 15% were hypothyroid, while 85% were non-hypothyroid. Analysis of TSH levels showed that 34.5% had low TSH, 50.5% had normal TSH, and 15% exhibited high TSH concentrations. Notably, T4 assessment revealed a high burden of hormone deficiency, with 71.5% presenting with low T4 and only 28.5% showing elevated T4. These findings indicate a widespread disturbance in thyroid hormone production consistent with chronic iodine deficiency.

In conclusion, hypothyroidism remains a significant health problem among women in this iodine-deficient region, with a remarkably high prevalence of low T4 levels. These results highlight the urgent need for sustained iodine supplementation programs, public health education, and routine thyroid screening to mitigate the burden of iodine deficiency disorders and their long-term complications.

Keywords: Thyroid status, Hypothyroidism, Iodine deficiency, Women's health, Thyroid hormones

Introduction

Iodine is a vital micronutrient required for the synthesis of thyroid hormones, primarily thyroxine (T4) and triiodothyronine (T3), which are essential for regulating metabolism, growth, and neurological development [1]. These hormones influence nearly every organ system, including the cardiovascular, reproductive, and central nervous systems. When dietary iodine intake is insufficient, the thyroid gland cannot produce adequate amounts of T4 and T3, leading to a spectrum of iodine deficiency disorders (IDD) such as goiter, hypothyroidism, and developmental impairments [2]. Women of reproductive age are particularly susceptible to thyroid dysfunction due to the increased metabolic demands associated with menstruation, pregnancy, and lactation, which elevate their iodine requirements [3].

Hypothyroidism, one of the most common manifestations of chronic iodine deficiency, is characterized by elevated thyroid-stimulating hormone (TSH) and reduced circulating T4 levels [4]. It can present as overt disease or as subclinical hypothyroidism, where biochemical abnormalities occur without obvious symptoms. Persistent hypothyroidism in women can lead to serious complications, including infertility, menstrual irregularities, adverse pregnancy outcomes, and developmental delays in infants [5]. These consequences underscore the importance of population-based screening and monitoring of thyroid function, especially in iodine-deficient regions.

Globally, significant progress has been made in reducing IDD through salt iodization programs; however, iodine deficiency

remains a public health concern in several low- and middle-income countries, including parts of sub-Saharan Africa and South Asia [6,7]. Even within countries that have adopted iodization policies, regional disparities persist due to variations in dietary practices, socioeconomic factors, and the coverage of fortification programs. Studies in endemic areas consistently report higher prevalence rates of hypothyroidism compared to iodine-sufficient regions [8]. This variation highlights the importance of region-specific investigations to guide local interventions.

Monitoring both TSH and T4 levels provides valuable insights into thyroid status and helps identify individuals at risk for both overt and subclinical hypothyroidism [5]. TSH is a sensitive marker of early thyroid failure, while T4 levels indicate the severity of hormonal deficiency. Previous studies in iodine-deficient areas have documented high rates of low T4 and elevated TSH, reflecting both primary hypothyroidism and the adaptive changes of the thyroid gland in response to chronic iodine scarcity [1].

This study investigates changes in thyroid status among women living in a region with documented iodine deficiency. By assessing the prevalence of hypothyroidism and examining TSH and T4 concentrations, it aims to provide a clearer understanding of the burden of thyroid disorders in this vulnerable population. Such data are critical for informing public health strategies, including sustaining and expanding salt iodization programs, improving maternal nutrition, and implementing community-based education campaigns to reduce the

incidence of IDD and improve reproductive and general health outcomes.

Materials And Methods

Study Area

This study was conducted at the Jos University Teaching Hospital (JUTH), a major tertiary health facility located in Jos, Plateau State, North-Central Nigeria. JUTH serves as a referral center for surrounding states and provides a wide range of clinical services, including specialized endocrinology and metabolic care. The hospital receives patients from both urban and rural communities within Plateau State and neighboring regions where iodine deficiency disorders have been documented. The laboratory services at JUTH are equipped to perform advanced biochemical analyses, including thyroid function tests such as serum thyroid-stimulating hormone (TSH) and thyroxine (T4), ensuring reliable diagnostic evaluations.

Study Design

A retrospective descriptive study design was employed. This design was selected to allow analysis of pre-existing patient records to determine the prevalence of thyroid dysfunction and changes in thyroid hormone levels among women residing in an iodine-deficiency region.

Population of the Study

The study population comprised women who attended Jos University Teaching Hospital between January 2020 and December 2024 and who underwent thyroid function testing as part of routine clinical evaluation. Inclusion criteria were female patients aged 18 years and above with complete laboratory records of serum TSH and T4 concentrations. Records with incomplete data or with known non-iodine-

related thyroid disorders (such as post-thyroidectomy status or medication-induced thyroid dysfunction) were excluded from the analysis. In total, 200 women met the inclusion criteria and were included in the study.

Data Collection

Data were retrieved from the hospital's electronic medical records and laboratory databases. Information extracted included patient age, serum TSH values, and serum T4 levels. All identifying patient information was excluded to maintain confidentiality and comply with ethical standards for retrospective research. The thyroid status of participants was categorized as hypothyroid or non-hypothyroid based on established reference ranges: TSH >10 mIU/L was classified as hypothyroidism, whereas TSH ≤ 10 mIU/L was classified as non-hypothyroidism. Serum T4 values were categorized as low or high using the laboratory's reference interval (typically 60–150 nmol/L), enabling assessment of thyroid hormone distribution within the population.

Data Analysis

Data were entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS) version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics were applied to summarize demographic characteristics and laboratory findings. Frequencies and percentages were used to present categorical variables such as the prevalence of hypothyroidism, distribution of TSH levels (low, normal, high), and T4 status (low or high). Tables and figures were generated to illustrate the frequency distributions of hypothyroidism, TSH levels, and T4 concentrations among the study participants.

Table 1: Hypothyroidism among Women in an Iodine Deficiency Disorder Region

Status	Frequency (%)
Non-hypothyroidism	170(85.0)
Hypothyroidism	30(15.0)
Total	200 (100.0)

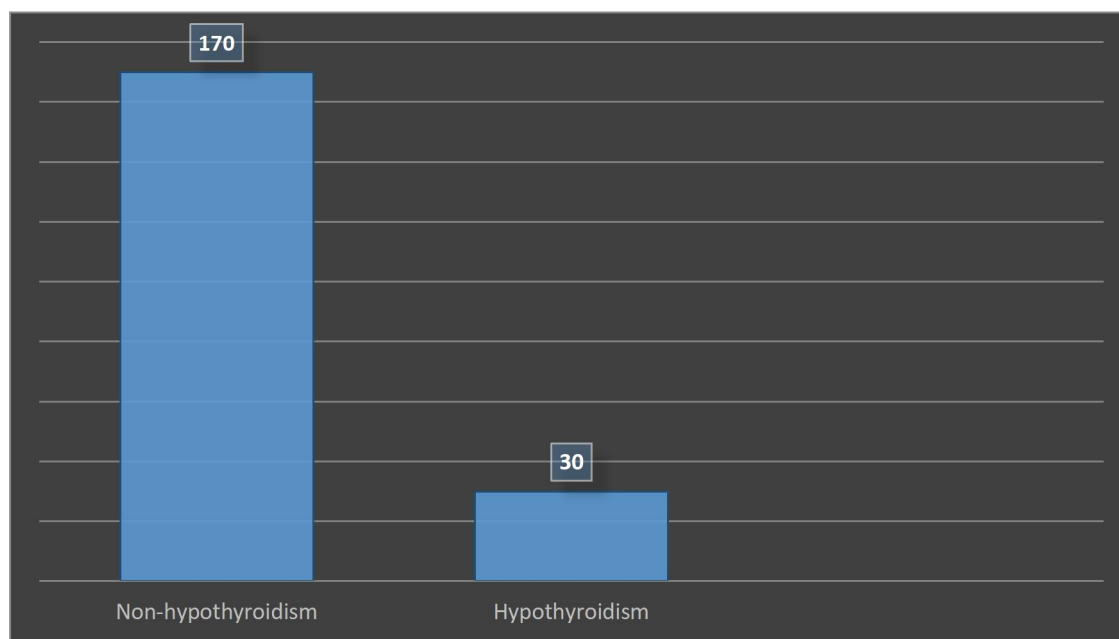


Figure 1: Hypothyroidism among Women in an Iodine Deficiency Disorder Region

Table 2: Occurrence of Thyroid Stimulating Hormone (TSH) among Women in an Iodine Deficiency Disorder Region

TSH	Frequency (%)
Low	69 (34.5)
Normal	101(50.5)
High	30(15.0)
Total	200(100.0)

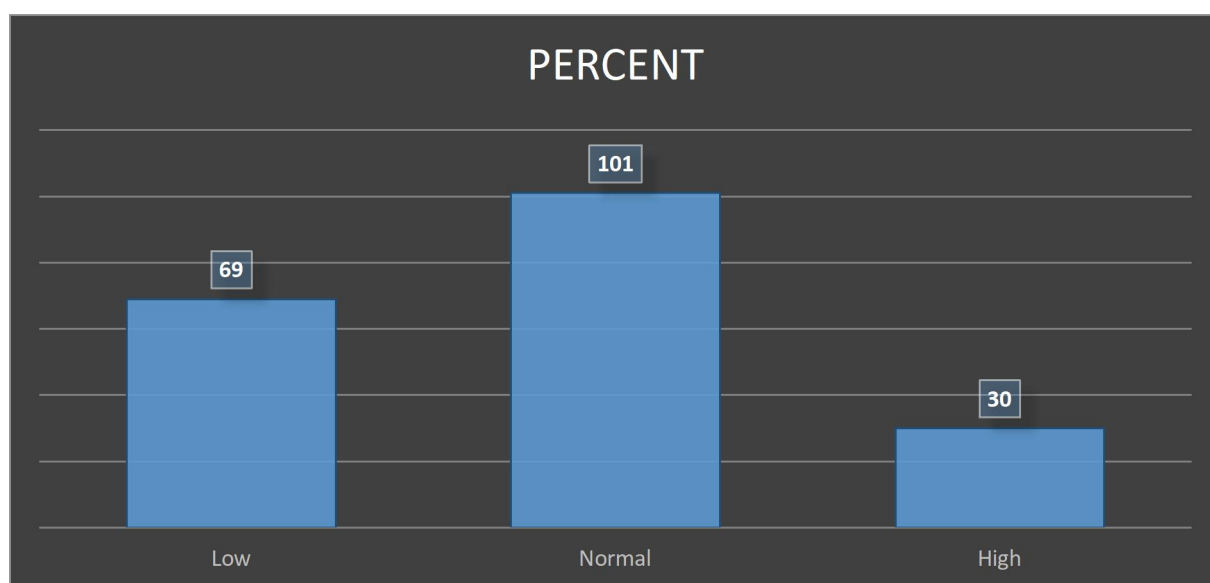


Figure 2: Thyroid Stimulating Hormone (TSH) among Women in an Iodine Deficiency Disorder

Table 3: Occurrence of T4 among Women in an Iodine Deficiency Disorder Region

T4	Frequency (%)
Low	143(71.5)
High	57 (28.5)
Total	200(100.0)

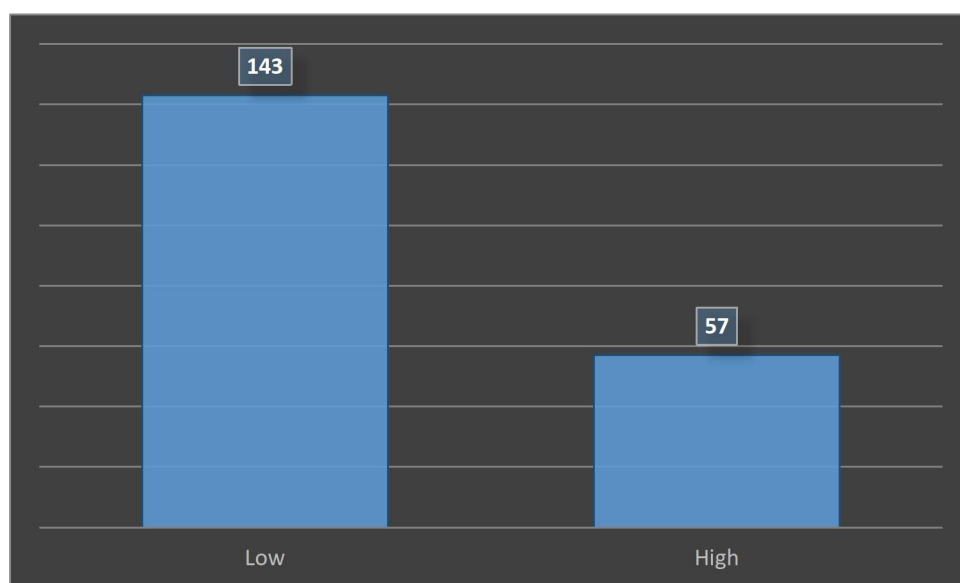


Figure 3: T4 among Women in an Iodine Deficiency Disorder Region

Discussion

This study assessed the thyroid status of women in an iodine-deficiency disorder (IDD) region, revealing 15.0 % prevalence of hypothyroidism among 200 respondents, while 85.0 % were non-hypothyroid [1]. This rate is markedly higher than the 3–5 % reported by Okosieme et al. in iodine-sufficient countries such as the United Kingdom [2], demonstrating the clear impact of iodine nutrition on thyroid health. At the same time, the prevalence in this study closely parallels findings from other iodine-deficient regions. Zimmermann et al. documented hypothyroidism rates between 12 % and 20 % in Himalayan communities with longstanding iodine deficiency [3]. Thus, this result contrasts sharply with iodine-replete settings but agrees with data from endemic zones, underscoring how persistent iodine scarcity sustains a higher disease burden.

When examining thyroid-stimulating hormone (TSH) distribution, 15.0 % of the women exhibited elevated TSH, matching the hypothyroidism prevalence and confirming its diagnostic reliability. However, 34.5 % showed low TSH, a strikingly high proportion compared with the 2–3 % reported in the U.S. NHANES survey [4]. This divergence highlights a unique feature of long-term iodine deficiency: chronic stimulation of the thyroid can lead to autonomous nodular growth and periods of suppressed TSH, a pattern described in other endemic areas [5]. Therefore, while the high-TSH group aligns with classical hypothyroidism as seen globally, the large low-TSH group contrasts with iodine-sufficient populations and mirrors reports of subclinical hyperthyroidism in IDD regions.

The T4 profile strengthens these observations. A remarkable 71.5 % of women had low T4, closely matching the 60 %+ hypothyroxinemia reported by Zimmermann et al. in northern India [3], and far exceeding the <10 % typically recorded in iodine-sufficient settings [2]. This similarity to other deficient regions reinforces the conclusion that inadequate iodine intake is the primary driver of low T4 levels. In contrast, the 28.5 % with high T4 departs from most IDD studies, where hyperthyroxinemia is uncommon. Yet Delange & Lecomte describe transient elevations of T4 in individuals with autonomous multinodular goiter, a phenomenon also seen in long-standing deficiency [5], suggesting that the high-T4 subgroup in our study may reflect nodular thyroid autonomy rather than simple iodine excess.

In Ethiopia, Gebre-Medhin et al. reported an 18 % hypothyroidism prevalence in an endemic goiter zone, nearly identical to our 15 %, whereas a Nigerian coastal population with adequate iodine intake showed only 4.8 % [6]. These contrasts within the same country emphasize how geography and iodine availability create distinct thyroid profiles: inland highland regions like Jos remain vulnerable to deficiency, while coastal communities are comparatively protected.

Conclusion

This study demonstrates that iodine deficiency remains a significant public health concern among women in the investigated region. An overall hypothyroidism prevalence of 15% was recorded, with half of the participants showing normal TSH levels, one-third exhibiting low TSH, and a striking 71.5%

presenting with low T4. These findings clearly indicate a population-wide disturbance of thyroid hormone production and regulation consistent with chronic iodine deficiency.

The coexistence of both high and low TSH values alongside markedly low T4 reflects the complex physiological response to long-term iodine scarcity, including the development of autonomous nodular goiter and mixed patterns of hypo- and hyperthyroid states.

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