

A Comparative Study on Thyroid Hormone Levels of Women Patients with reference to their Age groups

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Abstract

This study evaluated T₃, T₄ and TSH levels among women patients with the help of Thyroid Function Test. It was noted that T₃ hormone levels were recorded high among the patients of age group 11 to 20 years, whereas T₄ levels were recorded low in the age group of 41 to 50 years. TSH levels were recorded low in the age group of 11 to 20 years. Thyroid hormones regulate the metabolic processes that are needed for normal development and growth. Thyroid hormones control the metabolism and development of ovarian, uterine, and placental tissues, making them necessary for the proper functioning of the female reproductive system. Women with hypothyroidism or hyperthyroidism may experience infertility or subfertility as a result.

Keywords: Thyroid, T₃, T₄, TSH, thyroid function test, hyperthyroidism, infertility.

Introduction

The thyroid gland grows into a bi-lobed structure anterior to the trachea in mammals and is derived embryologically from endoderm at the base of the tongue. Thyroid tissue, on the other hand, differs greatly between organisms in terms of structure and organization. The thyroid gland is specialized to synthesize and secrete thyroxine (T₄) and triiodothyronine (T₃) into the bloodstream and receives a rich blood supply as well as sympathetic innervation (van der Spek *et al.*, 2017). Thyroid-stimulating hormone ([TSH], or thyrotropin), which is secreted by the pituitary and activated by thyrotropin-releasing hormone (TRH) from the hypothalamus, controls this method (Feldt-Rasmussen *et al.*, 2021). Thyroid gland regulatory mechanisms enable continuous development of thyroid hormone despite variations in dietary iodine supply. Thyroid hormone affects a variety of functions in amphibians, including metamorphosis, development, reproduction, growth, and metabolism (Louis *et al.*, 2024). The processes that are affected vary depending on the organisms, tissues, and developmental stage (Kress *et al.*, 2009). Thyroid hormones (THs) are important regulators of development, differentiation, and metabolism in the body (Mantzouratou *et al.*, 2021). They are essential for the proper functioning of nearly all tissues, with significant implications for metabolic rate and oxygen consumption (Mullur *et al.*, 2014). Thyroid gland disorders are among the most common endocrine disorders, which is unsurprising (Acosta *et al.*, 2024). Thyroid hormones are essential for the metabolism of almost all tissues in the body and play an important role in the growth of the fetus and infant CNS (Bernal, 2007). Thyroid hormones control the metabolic processes that are required for normal development and growth. Thyroid hormones regulate the metabolism and growth of ovarian, uterine, and placental tissues, making them essential for the proper functioning of the female reproductive system (Brown *et al.*, 2023). As a consequence, hypo and hyperthyroidism in women can lead to infertility or subfertility (Zamwar & Muneshwar, 2023). Considering the above facts in view, this study evaluated T₃, T₄ and TSH levels among women patients with the help of Thyroid Function Test with the following objectives:

1. To collect the patient serum samples from Local Hospital in Hosur, Krishnagiri District, Tamil Nadu.
2. To analyze thyroid levels (T₃, T₄ and TSH) using Thyroid Function Test (TFT).
3. To categorize the thyroid levels based upon age groups among the studied patients and interpretation of the data using normal values.

Materials and Methods

Specimen Collection: The blood sample of the patients (N=50) has been collected from the Local Hospital in Hosur, Krishnagiri District, TN and the sample was centrifuged to get the serum for hormone tests.

Thyroid Function Test (T₃, T₄ and TSH): Chemiluminiscence Immunoassay technique was used in this study to assay T₃, T₄ and TSH levels. Sample tubes are discharged inside three minutes in the wake of pipetting for further preparing. All reagents and supply materials (water, cuvettes, and pipette tips) might be refilled and waste might be purged amid a run. Reagents are blended physically before stacking and can then stay on-board the assay system for 28 days. Both assay cuvettes and pipette-tips are dispensable single use materials. The system is furnished with a clot-location gadget. Daily support comprises of a robotized washing methodology that takes around 40 minutes and the routine start-up takes around 10 minutes. The greatest throughput is 240 samples for every hour. The analyzer requires a zone of roughly 2.5 square meters for establishment. T₃, T₄ and TSH assay is a sandwich immunoassay utilizing paramagnetic microparticles as solid phase and direct chemiluminescence of acridinium ester for discovery of particular sign. Fifty microliters (μL) of sample are administered in a sample cuvette for T₃, T₄ and 200 μL of sample are administered in a cuvette for TSH. A homogenized suspension of the paramagnetic microparticles (225 μL) covered with a polyclonal sheep-against T₃, T₄ and TSH counter acting agent is then included; hatching for 5 minutes permits arrangement of the sandwich. The microparticles are isolated with magnets from the arrangement and washed. Corrosive and base reagent augmentations trigger the chemiluminescent response that is identified by a photomultiplier. The power of the light flag measured more than 5 seconds is directly identified with the T₃, T₄ and TSH fixation in the sample. A predefined master alignment curve of the individual reagent lot is perused from the reagent cartridges by a standardized identification scanner. This master curve is balanced by the client utilizing two calibrators when another reagent lot is initially presented and after a suggested interim of 28 days. The assay is standardized by worldwide standard readiness. The measuring scope of the TSH assay is from 0.004 μIU/ml (logical affectability) to μIU/ml Results are accounted for around 15 minutes subsequent to pipetting the sample. The reference range suggested for T₃, T₄ and TSH assay are 2.30-4.2 picogram/ml, 0.89-1.76 nanogram/dl and 0.35-5.5 μIU/ml respectively.

Results and Discussion

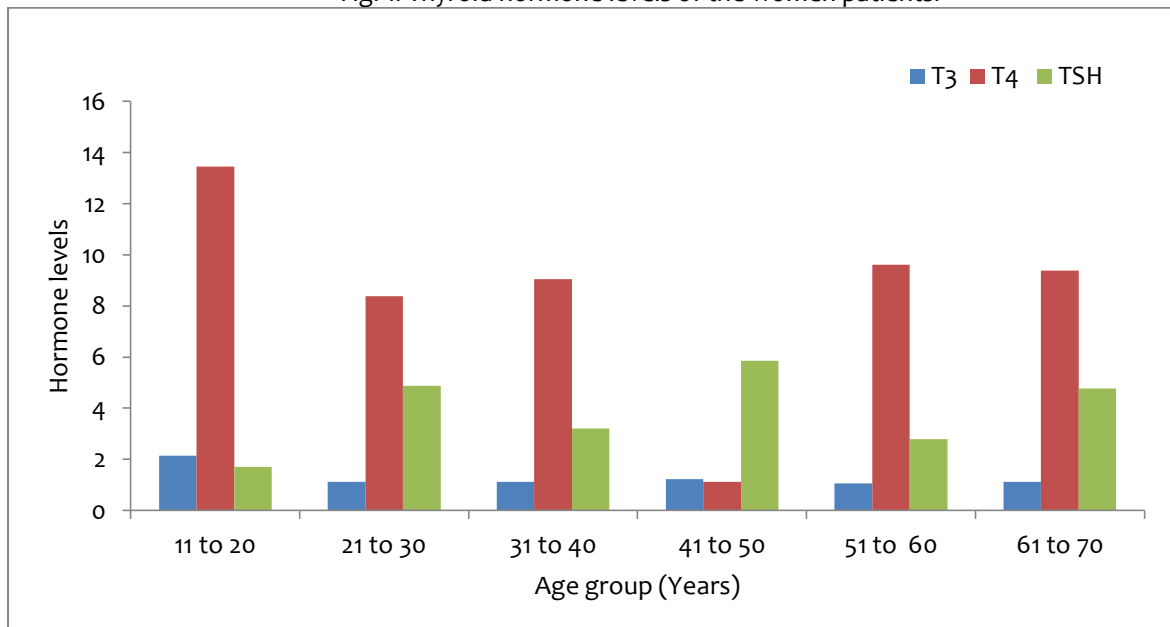
Thyroid hormones play an essential regulatory role in maintaining human metabolism, growth, and tissue development. Triiodothyronine and thyroxine exert direct control over the basal metabolic rate, energy homeostasis, and cellular respiration throughout various organ systems (Silva *et al.*, 2018). Within the context of the female reproductive system, appropriate thyroid activity is indispensable. Thyroid receptors expressed across ovarian, uterine, and placental tissues facilitate normal physiological processes, including follicular maturation, endometrial receptivity, and steroidogenesis (Brown *et al.*, 2023). This study evaluated triiodothyronine (T₃), thyroxine (T₄), and thyroid-stimulating hormone (TSH) levels among female patients using a Thyroid Function Test (TFT). Based on the observations presented in Table 1 and Figure 1, circulating T₃ hormone levels were recorded at their highest among young female patients in the adolescent age group (11 to 20 years). Conversely, T₄ hormone concentrations reached low levels among women in the mature age group of 41 to 50 years. Serum TSH levels were recorded low in the 11 to 20 age bracket (Table 1; Fig. 1).

The functional integrity of the hypothalamic-pituitary-gonadal (HPG) axis relies heavily on proper regulation from the thyroid hormone axis (Brown *et al.*, 2023). T₃ directly acts on human granulosa cells to stimulate progesterone and estrogen secretion, promoting normal ovulation (Silva *et al.*, 2018). Furthermore, thyroid hormones modulate the synthesis and availability of sex hormone-binding globulin (SHBG). When circulating levels of T₃ or T₄ fluctuate, the hepatic synthesis of SHBG shifts, altering the concentration of bioavailable sex steroids in systemic circulation (Silva *et al.*, 2018). Because thyroid hormones interact directly with uterine, ovarian, and placental tissues, endocrine imbalances—such as overt or subclinical hypothyroidism and hyperthyroidism—frequently result in reproductive pathology (Dosiou, 2020). Elevated serum TSH paired with low circulating T₄ levels (hypothyroidism) can trigger elevated prolactin production via thyrotropin-releasing hormone (TRH) stimulation, which subsequently inhibits gonadotropin-releasing hormone (GnRH) secretion and disrupts normal menstrual cyclicity (Brown *et al.*, 2023).

Table 1. Thyroid hormone levels of the women patients.

Age group (Years)	T3 (Triiodothyronine) pg/mL	T4 (Tyroxine) µg/dL	TSH µIU/mL
11 to 20	2.13	13.45	1.7
21 to 30	1.12	8.38	4.87
31 to 40	1.11	9.05	3.2
41 to 50	1.21	1.11	5.86
51 to 60	1.05	9.62	2.78
61 to 70	1.11	9.38	4.77

Fig. 1. Thyroid hormone levels of the women patients.



Consequently, women experiencing thyroid dysfunction present higher rates of menstrual irregularities, an ovulatory cycles, subfertility, and infertility (Dosiou, 2020). Correcting these age-dependent thyroid abnormalities through targeted evaluation and clinical management remains crucial for restoring reproductive function and ensuring healthy metabolic outcomes.

Conclusion

This study evaluated T3, T4 and TSH levels among women patients with the help of Thyroid Function Test. It was noted that T3 hormone levels were recorded high among the patients of age group 11 to 20 years, whereas T4 levels were recorded low in the age group of 41 to 50 years. TSH levels were recorded low in the age group of 11 to 20 years. Thyroid hormones regulate the metabolic processes that are needed for normal development and growth. Thyroid hormones control the metabolism and development of ovarian, uterine, and placental tissues, making them necessary for the proper functioning of the female reproductive system. Women with hypothyroidism or hyperthyroidism may experience infertility or subfertility as a result.

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