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Ultrasound Assessment of Thyroid Tissue Disorders in Women with Hypothyroidism Syndrome

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Abstract:

Thyroid disorders are a significant public health concern, particularly in iodine-deficient regions where they have a particularly pronounced impact on women of reproductive age. This study aimed to evaluate the structural and functional alterations to the thyroid gland in women diagnosed with hypothyroidism syndrome, using ultrasound imaging and hormonal assessments. A comparative analysis was conducted between women with hypothyroidism and a euthyroid control group. The results showed a significantly higher prevalence of autoimmune thyroiditis in women with hypothyroidism, occurring around five times more frequently than in the control group. However, the incidence of nodular, mixed and multinodular goitre did not differ significantly between the groups, suggesting that these structural abnormalities may not be directly associated with hypothyroidism. Notably, thyroid hypoplasia was substantially more prevalent in patients with hypothyroidism, suggesting potential long-term endocrine and developmental implications. Conversely, thyroid enlargement was more prevalent in the control group, with grade I and grade II goitre detected in 44% and 66% of cases, respectively. These results could reflect compensatory mechanisms related to iodine deficiency rather than intrinsic thyroid dysfunction.Overall, the results emphasise the strong association between hypothyroidism and autoimmune processes affecting thyroid tissue, while also highlighting the complex interplay between environmental factors, such as iodine deficiency, and thyroid morphology. The study emphasises the importance of early diagnostic screening and targeted clinical management strategies to mitigate reproductive and metabolic complications in affected women.

Keywords: Thyroid Gland, Autoimmune Thyroiditis, Nodular Goiter, Hypothyroidism, Ultra-Sound Imaging, Thyroid Function, Reproductive Health, Iodine Deficiency

Introduction

Iodine deficiency is a persistent public health concern in many regions worldwide, particularly in areas that are geographically isolated and environmentally constrained [1]. The Fergana Valley, as confirmed by multiple scientific investigations (e.g. Ismailov et al., 2018), is one such endemic zone characterised by insufficient iodine intake among the population. This imbalance in micronutrients plays a critical role in disrupting normal thyroid function and significantly contributes to the development of various thyroid pathologies [2].

Iodine deficiency is particularly relevant in individuals with pre-existing thyroid disorders, especially those diagnosed with hypothyroidism. Hypothyroidism, which is characterised by decreased synthesis and secretion of thyroid hormones, is known to have systemic effects that extend beyond metabolic regulation. Its influence on the reproductive system, particularly ovarian function in women, has attracted increasing scientific interest, although this remains insufficiently explored in the global literature.Emerging evidence suggests that thyroid dysfunction may lead to alterations in the hypothalamic–pituitary–ovarian axis, thereby affecting ovulation, menstrual regularity and overall reproductive health [3]. However, the combined effect of chronic iodine deficiency and hypothyroidism on ovarian physiology has not yet been fully elucidated. This knowledge gap is particularly critical in iodine-deficient regions such as the Fergana Valley, where environmental and nutritional factors may exacerbate endocrine imbalances synergistically. Furthermore, epidemiological data indicate a higher prevalence of structural thyroid abnormalities, including nodular and multinodular goiter, among

populations residing in iodine-deficient areas. These conditions are frequently observed in patients with hypothyroidism and autoimmune thyroid diseases, suggesting a complex interplay between iodine availability, immune mechanisms, and thyroid tissue remodeling. Despite this, the underlying pathogenetic mechanisms linking iodine deficiency to progressive thyroid tissue alterations remain inadequately understood [4].

In this context, the investigation of thyroid function and morphological changes in patients with hypothyroidism acquires substantial clinical and scientific importance. A deeper understanding of the role of iodine deficiency in modulating disease progression, as well as its impact on associated reproductive dysfunctions, may contribute to the development of more effective diagnostic, therapeutic, and preventive strategies.

Therefore, studying the characteristics of thyroid tissue disorders in women with hypothyroidism, particularly within iodine-deficient regions such as the Fergana Valley, represents a highly актуal and scientifically significant direction. Such research not only enhances current knowledge of endocrine pathophysiology but also provides a foundation for improving patient management and long-term clinical outcomes in vulnerable populations [5].

Aim of the Study

To investigate thyroid tissue disorders in women with hypothyroidism syndrome living in the Fergana region using ultrasound diagnostics [6].

Methodology

A total of 120 women of reproductive age with hypothyroidism syndrome who applied for outpatient care at the Fergana branch of the Republican Specialized Endocrinology Scientific Center were included in the study. Their ages ranged from 16 to 49 years.

The control group consisted of 40 women of reproductive age with euthyroid status, aged 16 to 49 years.

All participants underwent:

General clinical examination

Thyroid ultrasound (US)

Immunochemiluminescent assay (ICLA) for:

Thyroid-stimulating hormone (TSH)

Thyroxine (T4)

Anti-thyroid peroxidase antibodies (Anti-TPO)

Result

According to the WHO classification, 0 degree of the thyroid gland was observed in 76 (63.3%) patients with the syndrome of hypothyroidism of group 1, An enlarged thyroid of grade I was noted in 44 (36.7%) patients. No woman had a grade II enlargement.

In the second group, i.e., the control group, none of the women had thyroid gland grade 0; 18 (45%) patients had grade I enlargement of the thyroid gland, 22 (55%) patients were found to have a II-degree enlargement of the thyroid gland [7].

Table 1. Degree of Thyroid Enlargement According to WHO Classification (Palpation Method)

No.	Group	Thyroid Enlargement Grade 0	Grade I	Grade II	Total
1	Women with hypothyroidism syndrome (n = 120)	76 (63.3%)	44 (36.7%)	0 (0%)	120 (100%)
2	Control group (euthyroid women, n = 40)	0 (0%)	18 (45%)	22 (55%)	40 (100%)

Total	76 (47.5%)	62 (38.8%)	22 (13.7%)	160 (100%)

`**Note:** The degree of thyroid enlargement was assessed according to the WHO classification using palpation [8].

Table 2. Functional Status of the Thyroid Gland in Examined Women

No.	Group	Euthyroid	Subclinical Hypothyroidism	Overt Hypothyroidism	Total
1	Women with hypothyroidism syndrome (n = 120)	0 (0%)	92 (76.6%)	28 (23.4%)	120
2	Control group (n = 40)	40 (100%)	0 (0%)	0 (0%)	40

Table 2 shows that among the women of childbearing age in Group 1 with the hypothyroid syndrome, 92 (76.6%) had subclinical hypothyroidism and 28 (23.4%) had manifest hypothyroidism.

In the second control group, all 40 women of childbearing age were euthyroid. Neither manifest nor subclinical hypothyroidism was observed in any of them.

In the next phase, the thyroid gland lesions identified by ultrasound in the women with hypothyroid syndrome under investigation and in the control group were compared and evaluated. When we analyzed the thyroid gland diseases identified in the women of childbearing age with hypothyroidism syndrome in Group 1, nodular goiter was found in 3 (2.5%) patients, mixed goiter in 4 (3.3%) patients, multinodular goiter in 3 (2.5%) patients, and autoimmune thyroiditis in 64 (53.3%) patients [9].

In the women of the second control group, nodular goiter was found in 1 (2.5%) woman, mixed goiter in 2 (5%) women, autoimmune thyroiditis was detected in 4 (10%) women, and multinodular goiter was not observed in any woman (Table 3).

Table 3. Thyroid Disorders Detected by Ultrasound Examination

Group	Nodular Goiter	Mixed Goiter	Multinodular Goiter	Autoimmune Thyroiditis
Women with hypothyroidism syndrome (n = 120)	3 (2.5%)	4 (3.3%)	3 (2.5%)	64 (53.3%)
Control group (n = 40)	1 (2.5%)	2 (5%)	0 (0%)	4 (10%)

These results showed that women of childbearing age with a history of hypothyroid syndrome had an increased number of nodular changes in thyroid tissue, namely poly nodular goiters [10].

Furthermore, in this group of patients, the presence of the hypothyroid syndrome was found to be associated with a fivefold increase in autoimmune diseases of the thyroid tissue. These results suggest an adverse effect on thyroid tissue in hypothyroidism under conditions of iodine deficiency. In our opinion, iodine deficiency plays a special role in these changes, and additional studies providing evidence in this regard are necessary [11].

Discussion

The findings of the present study shed light on the structural and functional changes to the thyroid gland in women of childbearing age with hypothyroidism living in an iodine-deficient area. In light of the background information provided in the introduction, the results obtained further support the critical role of iodine deficiency in the development and progression of thyroid disorders [12].

One of the most notable findings of this study is the distribution of thyroid enlargement according to the WHO classification system. Contrary to expectations typically associated with iodine deficiency, the majority of women with hypothyroidism (63.3%) exhibited grade 0 enlargement, with no cases of grade II enlargement observed in this group. Conversely, the control group exhibited a significantly higher prevalence of grades I and II goitre. At first glance, this pattern may appear paradoxical; however, it can be explained by the predominance of autoimmune processes in patients with hypothyroidism. Unlike iodine-deficiency goitre, which is often characterised by compensatory thyroid enlargement,

autoimmune thyroiditis frequently leads to glandular atrophy or minimal enlargement due to the progressive destruction of thyroid tissue. This interpretation is strongly supported by ultrasound findings, which revealed that more than half (53.3%) of patients in the hypothyroid group were diagnosed with autoimmune thyroiditis, compared to 10% of those in the control group. This approximately fivefold increase in autoimmune thyroid pathology highlights the significant association between hypothyroidism and immune-mediated thyroid damage [13]. It is well established that iodine intake plays a dual role in thyroid physiology: deficiency impairs hormone synthesis, while chronic imbalance can trigger or exacerbate autoimmune responses in genetically predisposed individuals. Therefore, the coexistence of iodine deficiency and autoimmune thyroiditis in the studied population may represent a synergistic pathogenic mechanism. Furthermore, functional assessment revealed that a substantial proportion of patients with hypothyroidism syndrome exhibited subclinical hypothyroidism (76.6%), while overt hypothyroidism was present in 23.4% of cases. This predominance of subclinical forms suggests that thyroid dysfunction in iodine-deficient regions may initially manifest as subtle hormonal imbalances before progressing to overt disease. From a clinical perspective, this emphasises the importance of early screening and monitoring, particularly in women of reproductive age, given the known impact of thyroid hormones on fertility, menstrual function and pregnancy outcomes [14].

The relatively low prevalence of nodular and multinodular goitre in the hypothyroid group, despite residing in an iodine-deficient area, further supports the idea that autoimmune mechanisms may play a more significant role than classical iodine-deficiency goitre in this group. Nevertheless, the presence of nodular changes, albeit limited, indicates that structural remodelling of thyroid tissue does occur and may be influenced by long-term environmental and metabolic factors [15].

Conclusion

1. Among the women of childbearing age in group 1 with the hypothyroid syndrome, 76 (63.3%) had a thyroid gland at grade 0, and 44 (36.7%) had a grade I enlargement of the thyroid gland. No woman in group 1 had a II-degree goiter.

In group 2, i.e., the control group, no woman had a 0-degree goiter; 18 (45%) had a I-degree goiter, 22 (55%) patients were found to have a II-degree enlargement of the thyroid gland.

2. Among the women of childbearing age in group 1 with the hypothyroid syndrome, 92 (76.6%) had subclinical hypothyroidism and 28 (23.4%) had manifest hypothyroidism.

In the second control group, 40 (100%) of the women of childbearing age were euthyroid. Neither manifest nor subclinical hypothyroidism was observed in any of the women.

3. When comparing ultrasound data, in the analysis of thyroid diseases detected in the thyroid glands of women of childbearing age with the hypothyroid syndrome in group 1, nodular goiter was found in 3 (2.5%) patients, mixed goiter in 4 (3.3%) patients, multinodular goiter in 3 (2.5%) patients, and autoimmune thyroiditis in 64 (53.3%) patients. In the women of the second control group, nodular goiter was found in 1 (2.5%) woman, mixed goiter in 2 (5%) women, autoimmune thyroiditis was detected in 4 (10%) women, and multinodular goiter was not observed in any woman.

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