

Correlation Between Vitamin D Deficiency and Subclinical Hypothyroidism

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Abstract Vitamin D deficiency is one of the global health problems today. In recent years, the direct effect of this vitamin not only on the musculoskeletal system, but also on the work of the endocrine and immune systems has been studied on a large scale. However, the role of vitamin D in the course of subclinical hypothyroidism is not fully understood. Subclinical hypothyroidism is a disease accompanied by borderline changes in thyroid hormones, but not manifested by obvious clinical signs, its prevalence has been increasing in recent years. Studies suggest that vitamin D deficiency may be directly related to subclinical hypothyroidism. At the same time, a decrease in the level of vitamin D is observed, a violation of thyroid gland, an increase in autoimmune processes and a combination with hypocalcemia. Also, vitamin D deficiency is inversely correlated with TSH levels, which may determine the severity of hypothyroidism compensation. Thus, in patients with subclinical hypothyroidism, it is recommended to regularly monitor the level of vitamin D and correct it if insufficiency is detected. This is of great importance for the early detection of the disease, the prevention of severe clinical forms, and the improvement of patients' quality of life. Vitamin D deficiency is a global public health problem. Vitamin D's role as an immunomodulator is highlighted. Today, the effect of vitamin D on the course of autoimmune diseases is actively studied. Vitamin D deficiency is a global health problem.

Keywords Vitamin D deficiency, Subclinical hypothyroidism, Thyroid gland, TSG, fT4

1. Introduction

More than 1 billion people worldwide are deficient or deficient in vitamin D [1]. Even today, the medical community is not sufficiently aware of the negative impact of this deficiency on human health and the need to achieve adequate levels of vitamin D in the blood [2]. The study of the role of vitamin D has been ongoing since its discovery as a simple vitamin at the beginning of the 20th century to the present day [3]. It has been found that in addition to its prominent role in calcium homeostasis and the development of the musculoskeletal system, vitamin D also influences the functioning of the immune system [3]. It has also been found that vitamin D deficiency is associated with autoimmune diseases such as rheumatoid arthritis, systemic red sclerosis disease, Crohn's disease, multiple sclerosis, and type 1 diabetes, while supplemental vitamin D intake has been proven to prevent their occurrence or development [4]. In addition, decreased levels of vitamin D in the blood have been noted in patients with Hashimoto's thyroiditis, an autoimmune thyroid disease [5].

Vitamin D enters the bloodstream in the form of an attachment to the vitamin D-binding protein, is hydroxylated through the liver to 25(OH)D, and then converted to the active metabolite in the kidneys – 1,25-dihydroxyvitamin D, that is, calcitriol [6]. The most reliable indicator for assessing the status of vitamin D intake is the amount of 25(OH)D in the blood serum [7]. According to modern recommendation [8]:

- Vitamin D deficiency – if the level of 25(OH)D is below 20 ng/ml (50 nmol/l),
- Vitamin D deficiency – when the level of 25(OH)D is 21–29 ng/ml (50.1–74.9 nmol/l),
- Normal level – 25(OH)D when above 75.0 nmol/l,
- Severe deficiency, on the other hand, is detected at readings below 25 nmol/l [8].

It is worth noting that both vitamin D and thyroid hormones bind to steroid hormone receptors. The presence of certain vitamin D receptor genes leads to a susceptibility to autoimmune thyroid diseases (diffuse toxic bull, autoimmune thyroiditis). Therefore, the role of the vitamin D system in this pathology is great [9]. Vitamin D exerts its action by binding to the vitamin D receptor (VDR) and activating VDR-sensitive genes. Polymorphism of the VDR gene has been found to be associated with autoimmune thyroid gland disease [9].

Key Section

The purpose of the study was to determine the relationship between subclinical hypothyroidism and vitamin D deficiency.

2. Materials and Styles

During the study, 80 permanent residents (in the Fergana region) with their written consent were observed in conditions of iodine deficiency. The study was conducted during 2023-2025.

Participants were divided into two main groups:

Group I – 60 patients with primary subclinical hypothyroidism (24 males – 40% and 36 women – 60%), mean age 48.8 ± 5.4 years. The diagnosis of hypothyroidism is confirmed by their medical records.

Group II (control group) – 20 practically healthy individuals (8 males – 40% and 12 females – 60%), average age 45.2 ± 6.7 years. They were not under dispensary supervision due to any chronic diseases, have no history of thyroid disease, and were not taking vitamin D drugs.

In study participants, the following were studied: complaints, history data, clinical trial results, thyrotropic hormone (TSH), free thyroxine (fT4) levels, and levels of 25(OH)D in the blood serum.

3. Research Findings

The average values of the indicators of 25(OH)D, ionized calcium, thyroid gland functional status in blood serum in the participants of the two groups are shown in Table 1. No reliable differences were found between the age and sex content groups.

Table 1. The average value of indicators of groups I and II

	Group I	Group II	p
Gender	24 males 36 females	8 males 12 females	>0.05
Age	48.8 ± 5.4	45.2 ± 6.7	>0.05
25(OH)D nmol/l	21.7 ± 1.1	27.3 ± 1.2	<0.05
TSH	8.26 ± 1.72	1.16 ± 0.41	<0.001
fT4	1.44 ± 0.26	1.69 ± 0.21	<0.001

As a result of a comparison of the indicators of the two groups, it was found that serum levels of 25(OH)D in patients diagnosed with subclinical hypothyroidism were reliably lower than in the control group ($p < 0.05$). TSH levels in blood serum were significantly higher in patients with hypothyroidism than in the control group ($p < 0.001$). When the rates were compared, when the indicators were compared, 25(OH)D levels were slightly lower in women with subclinical hypothyroidism than in men, although this difference was not statistically significant ($p > 0.05$; Table 2).

Table 2. Gender Gap in Laboratory Tests in Patients With SG

	Men n=24	Women n=36	p
25(OH)D nmol/l	22.9 ± 1.2	20.7 ± 1.4	>0,05
TSH	$8,09 \pm 1,64$	$8,37 \pm 1,82$	>0,05

When sex-specific TSH values were analyzed in the subclinical hypothyroidism group, no reliable difference was found between males and females ($p > 0.05$).

In group I, a negative correlation was noted:

- 25(OH)D and TSH ($r = -0.589$; $p < 0.05$),
- No significant association was found with fT4 ($r = 0.45$; $p > 0.05$).

Although the main effects of vitamin D are related to bone metabolism and mineral homeostasis, it has recently been revealed that its deficiency is also associated with pathologies such as cardiovascular diseases, cancer, infections, obesity, in addition to osteoporosis [10].

In addition, vitamin D has an immunomodulatory effect and plays an important role in the pathogenesis of autoimmune diseases [9]. To date, only a handful of studies have been conducted to determine the relationship between vitamin D levels and thyroid hypofunction. However, there are conflicting data on the effect of vitamin D deficiency on the mechanisms of development of subclinical hypothyroidism or, conversely, whether this deficiency is a consequence of subclinical hypothyroidism itself.

The incidence rates of vitamin D deficiency and deficiency have been studied in Uzbekistan over the past decade, but the study we conducted is one of the first studies to establish the link between vitamin D and thyroid hypofunction.

Vitamin D levels were assessed in patients with subclinical hypothyroidism compared with a control group consisting of almost healthy individuals. The study found that in both groups, women's blood levels of 25(OH)D were not significantly lower than in men. In addition, this study found that vitamin D levels were significantly lower in patients with subclinical hypothyroidism than in the control group. A negative correlation with vitamin D and TSH levels was noted in both groups. These results allow us to suggest that there is a reliable relationship between vitamin D deficiency and subclinical hypothyroidism. It has been noted that vitamin D and thyroid hormones bind to the same steroid hormone receptors. The vitamin D analogue suppresses inflammatory responses in human thyroid gland cells and T-cells [18].

Some limitations of our present study are related to the small number of patients who were randomly examined, which does not allow us to draw a definitive conclusion about the direct effect of vitamin D status on the pathogenesis of subclinical hypothyroidism. Therefore, further prospective clinical studies are needed to determine the direct importance of vitamin D in patients with hypothyroidism. Levels of 25(OH)D were identified in 60 patients with subclinical hypothyroidism and 20 healthy individuals. Vitamin D deficiency was noted when its level was below 50 nmol/l. All

participants had levels of thyrotropic hormone (TSH), free thyroxine (free T4). According to the results, levels of 25(OH)D were reliably lower in patients diagnosed with subclinical hypothyroidism compared to the control group. Its levels were slightly lower in women than in men.

The results obtained indicate that vitamin D deficiency is reliably correlated with subclinical hypothyroidism compensation levels (TSH levels).

4. Conclusions

In patients with subclinical hypothyroidism, it is recommended to screen for vitamin D levels and additionally prescribe vitamin D drugs.

Vitamin D levels are reliably low (21.7 ± 1.1 nmol/l) in patients with subclinical hypothyroidism, significantly differing compared to healthy individuals (27.3 ± 1.2 nmol/l; $p < 0.05$).

Vitamin D has been found to have a positive reliable correlation with thyroid hormone levels, as well as a negative reliable correlation with TSH levels.

Vitamin D deficiency is confidently correlated with the severity of subclinical hypothyroidism, which makes it necessary to prescribe vitamin D supplementally. Vitamin D deficiency screening is recommended for all patients with hypothyroidism.

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