

THE ROLE OF SELENIUM AND ZINC IN THE PATHOGENESIS AND PROGRESSION OF THYROID DISEASES

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Abstract: *Thyroid diseases are a significant medical problem in modern healthcare, affecting metabolism regulation and overall health. Hypothyroidism, thyrotoxicosis, and autoimmune thyroid diseases are increasingly common worldwide, posing serious health challenges [1]. Disruptions in thyroid function can lead to metabolic disorders, mental health problems, and other severe complications [2].*

Several factors influence thyroid health, including deficiencies in trace elements and vitamins. Selenium, iodine, zinc, and vitamin D play crucial roles in thyroid function and may impact disease development and progression [3].

This review aims to analyze the existing literature on the effects of selenium, iodine, zinc, and vitamin D concentrations on the course and pathogenesis of thyroid diseases. By synthesizing these data, we aim to improve our understanding of the role of these trace elements and vitamins in thyroid disease etiology and treatment and to identify future research and clinical practice perspectives [4].

Introduction

Thyroid diseases, including hypothyroidism, hyperthyroidism, and autoimmune disorders such as Hashimoto's thyroiditis and Graves' disease, are prevalent worldwide and can lead to serious health consequences, including metabolic and mental disorders, as well as life-threatening complications if left untreated [5].

A deficiency in essential micronutrients, including selenium, iodine, zinc, and vitamin D, has been linked to thyroid dysfunction [6]. Selenium is involved in the conversion of thyroxine (T4) to triiodothyronine (T3) and protects thyroid cells from oxidative stress through selenoproteins such as glutathione peroxidase and thioredoxin reductase [7]. Zinc plays a role in the synthesis of thyroid hormones and modulates the immune response, which is particularly relevant for autoimmune thyroid diseases [8]. Iodine is a fundamental component of thyroid hormone synthesis, and its deficiency or excess can contribute to thyroid dysfunction [9]. Vitamin D is involved in immune regulation and may influence the pathogenesis of autoimmune thyroid diseases [10].

Discussion. Scientific evidence suggests that selenium deficiency is associated with increased susceptibility to oxidative stress in the thyroid, impaired hormone synthesis,

and a higher risk of autoimmune diseases [11]. At the same time, excessive selenium intake can lead to toxic effects, metabolic disorders, and endocrine dysfunctions [12].

Zinc deficiency has been linked to hypothyroidism, as zinc is required for thyroid hormone production and immune function [13]. Similarly, vitamin D deficiency has been associated with an increased prevalence of Hashimoto's thyroiditis and Graves' disease, potentially due to its role in immune modulation [14].

Research indicates that adequate selenium intake can reduce thyroid peroxidase antibody (TPO-Ab) levels, improve thyroid function, and serve as an adjunctive treatment for autoimmune thyroiditis [15]. Moreover, zinc supplementation has been shown to benefit thyroid function, particularly in individuals with low zinc levels [16].

Conclusion. Optimal selenium and zinc intake is crucial for maintaining thyroid health. Deficiencies in these trace elements can contribute to the development of hypothyroidism and autoimmune diseases, while adequate levels support thyroid hormone synthesis and protect against oxidative damage. However, selenium and zinc supplementation should be personalized based on individual needs, as excessive intake may lead to toxicity. Further clinical research is necessary to explore their precise role in thyroid disease prevention and treatment.

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