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The effect of a gluten-free diet on the biochemical parameters of patients with autoimmune thyroiditis

Abstract

The study of biochemical parameters after implementing a gluten-free diet in patients with autoimmune thyroiditis, a condition prevalent worldwide, holds significant practical and theoretical importance. The aim of the research is to determine how a gluten-free diet affects the progression dynamics of autoimmune thyroiditis by measuring the levels of triiodothyronine, thyroxine, thyroid-stimulating hormone and anti-thyroperoxidase antibodies in patients adhering to a gluten-free diet. The study were included 32 participants aged between 20 and 70 years, comprising 11 men and 21 women. The research was conducted using the enzyme-linked immunosorbent assay (ELISA) method on the "Mindray BA-88A" analyzer.

Keywords: *Autoimmune thyroiditis, Gluten-free diet, FT3, FT4, Anti-TPO*

Introduction

Autoimmune thyroiditis is an autoimmune disease of the thyroid gland. The disease was first described in 1912 by the Japanese scientist and physician Hakaru Hashimoto as an enlargement of the thyroid gland due to lymphoid infiltration, under the name lymphomatous hypertrophic goiter (Alimetov, Ibrahimova, 2014). Hakaru Hashimoto described four cases of the disease (Ihnatowicz, Wator, Drywien, Wojsiat, n.d.). Besides autoimmune thyroiditis, this condition is also known as lymphocytic thyroiditis, chronic autoimmune thyroiditis, lymphadenoid goiter, Hashimoto's thyroiditis or Hashimoto's disease (Alimetov, Ibrahimova, 2014; Mammadhasanov, 2019; Seed, 2024). the global prevalence of the disease is approximately 10-12%, while its occurrence among Caucasians is estimated to be around 5% (Kalaycı, Kamarlı, 2014; Aghayeva, Hasanguliyeva, Namazova, 2024). Autoimmune thyroiditis is 15-20 times more common in women than in men. The higher prevalence in women is associated with X chromosome abnormalities and the influence of estrogens on the lymphoid system (Saidova, Mirzazade, 2016). Age-related changes in the thyroid gland lead to an increased production of proteins associated with autoimmune processes, which is why autoimmune thyroiditis typically develops gradually. The risk of disease progression increases with age (Ihnatowicz, Wator, Drywien, Wojsiat, n.d.).

Research

In patients with autoimmune thyroiditis, an increase in TSH hormone and anti-TPO antithyroid antibodies, along with a decrease in FT3 and Ft4 hormone levels are key indicators of the disease (Imamoglu, Ozyardımcı Ersoy, 2019).

Thyroid-stimulating hormone – TSH is a glycoprotein complex protein synthesized in the basophilic cells of the adenohypophysis. The half-life of this hormone in the blood is between 50 and 60 minutes. The primary function of TSH is to stimulate the formation and function of the thyroid gland. The binding of TSH to the membrane receptors of thyroid cells accelerates the synthesis of cyclicAMP – cAMP in the gland.

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As a result of increased cAMP levels, the uptake of iodine by thyrocytes and the iodination of thyroglobulin are stimulated (Islamzade, Efendiyev, Islamzade, 2015). TSH influences the synthesis of thyroid hormones by stimulating the entry of iodine ions into thyrocytes and the iodination of tyrosyl residues (Islamzade, Efendiyev, Islamzade, 2015). The level of TSH is an important parameter that indicates the free values of thyroid hormone in the blood. As a result of reduced thyroid function, TSH synthesis increases. When thyroid hormone synthesis decreases, TSH synthesis rises and when it increases, TSH synthesis decreases. TSH is the first step in obtaining information about thyroid function (Imamoglu, Özyardımcı Ersoy, 2019).

Thyroid hormone – thyroxine – T4 and triiodothyronine – T3 are different from other hormones because they are iodinated compounds. These hormones are synthesized within the thyroglobulin, the colloidal protein substance found in the follicles of the thyroid gland. Thyroid hormones circulate in the blood bound to serum proteins. 99.97% of thyroxine and 99.7% of triiodothyronine circulate bound to proteins in the blood. 0.03% of thyroxine and 0.3% of triiodothyronine circulate freely in the blood, exerting biological effects on target cells. Thyroid hormones participate in a variety of biochemical changes in cells, including the metabolism of proteins, carbohydrates, lipids and nucleic acids, glucose and potassium into cells and the movement of calcium and phosphorus out of cells (Islamzade, Efendiyev, Islamzade, 2015).

Anti-thyroperoxidase – Anti-TPO antibodies play a crucial role in the diagnosis of autoimmune thyroiditis. The enzyme thyroperoxidase is located in the thyroid cytoplasm. Anti-TPO antibodies bind to the C-terminal part of the thyroperoxidase enzyme in the cytoplasm and induce apoptosis of thyrocytes (Imamoglu, Ozyardımcı Ersoy, 2019).

Several factors play a role in the etiology of autoimmune thyroiditis. These factors include genetic predisposition, infection, surgical intervention in the thyroid gland, inflammation of the gland, radiation, sedentary lifestyle, changes in dietary habits, psychological stress and the intake of foods that alter the composition of the gut microbiota (Mammadhasanov, 2019; Ulker, Aritici, Bash, Erdem, n.d.). Considering all these factors, a gluten-free diet has recently been recommended for patients with autoimmune thyroiditis. During a gluten-free diet, wheat, barley, rye and foods, beverages, medications and supplements containing these are removed from the diet. A gluten-free diet leads to a decrease in thyroid antibodies and prevents the progression of the autoimmune process. The mechanism by which this diet affects autoimmune thyroiditis is explained by a reduction in the levels of circulating proinflammatory cytokines, a decrease in intestinal permeability and an improvement in the absorption of selenium and vitamin D, which re essential thyroid gland health (Piticchio, Frasca, Malandrino, Trimboli, Carrubba, Tumminia, Vinciguerra, Frittitta, n.d.; Malanrini, Trimboli, Guzzaloni, Virili, Lucchini, n.d.; Krysiak, Szkrobka, & Okopieri, n.d.).

Conclusion

The participants in the study were classified into 3 groups. In the control group consisting of healthy individuals, among the 10 participants, 40% of men had an average FT3 level of 2.73pg/ml in their blood serum, while 60% of women had an average FT3 level of 2.95pg/ml in their blood serum. In the group 10 autoimmune thyroiditis patients unrelated to a gluten-free diet, 30% of men had an average FT3 level of 0.97pg/ml in their blood serum, while 705 of women had an average FT3 level of 1.14pg/ml in their blood serum. In the group of 12 autoimmune thyroiditis patients adhering to a gluten-free diet, 33.3% of men had an average FT3 level of 2.83pg/ml in their blood serum, while 66.7% of women had an average FT3 level of 2.73pg/ml in their blood serum.

In a control group of 10 participants, 40% of men had an average FT4 level of 1.63µg/dl in their blood serum, while 60% of women had an average FT4 level of 1.57µg/dl in their blood serum. In the group of 10 autoimmune thyroiditis patients nor adhering to a gluten-free diet, 30 of men had an average FT4 level of 1.13µg/dl in their blood serum, while 705 of women had an average FT4 level of 1.16µg/dl in their blood serum. In the group of 12 autoimmune thyroiditis patients adhering to a gluten-free diet, 33.3% of men had an average FT4 level of 1.53µg/dl in their blood serum, while 66.7% of women had an average FT4 level of 1.38µg/dl in their blood serum.

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In the control group consisting of 10 participants, 40% of men had an average TSH level of 2.93mIU/l in their blood serum, while 605 of women had an average TSH level of 2.92mIU/l in their blood serum. In the group of the 10 autoimmune thyroiditis patients not adhering to a gluten-free diet, 30% of men had an average TSH level of 5.74mIU/l in their blood serum, while 70% of women had an average TSH level of 4.99mIU/l in their blood serum. In the group of 12 autoimmune thyroiditis patients adhering to a gluten-free diet, 33.3% of men had an average TSH level 0f 3.18mIU/l in their blood serum, while 66.7% of women had an average TSH level of 2.66mIU/l in their blood serum.

In the control group consisting of participants, 40% of men had an average Anti-TPO antibody level of 19.4 IU/ml in their blood serum, while 60% of women had an average Anti-TPO antibody level of 16.8 IU/ml in their blood serum. In the group of autoimmune thyroiditis patients not adhering to a gluten-free diet, 30% of men had an average Anti-TPO antibody level of 758 IU/ml in their blood serum, while 70% of women had an average Anti-TPO antibody level of 745.6 IU/ml in their blood serum. In the group of 12 autoimmune thyroiditis patients adhering to a gluten-free diet 33.3% of men had an average Anti-TPO antibody level of 21.8 IU/ml in their blood serum, while 66.7% of women had an average Anti-TPO antibody level of 17.8 IU/ml in their blood serum.

Indicator		Control group		Autoimmune thyroiditis patients group			
		20-70 years		20-70 years			
		Group I		Group II		Group III	
	Gender	M	F	M	F	M	F
	Number	4	6	3	7	4	8
FT3	M	2.73	2.95	0.97	1.14	2.83	2.73
FT4	M	1.63	1.57	1.13	1.16	1.53	1.38
TSH	M	2.93	2.92	5.74	4.99	3.18	2.66
Anti-TPO	M	19.4	16.8	758	745.6	21.8	17.8

As shown by the results of the study, in autoimmune thyroiditis patients not adhering to a gluten-free diet, the levels of FT3 and FT4 hormones in their blood serum were lower compared to healthy individuals, while the levels of TSH hormone and Anti-TPO antibodies were higher compared to healthy individuals. In autoimmune thyroiditis patients adhering to a gluten-free diet, the levels of FT3, FT4, TSH hormones and Anti-TPO antibodies in their blood serum were similar to those of healthy individuals. Therefore, it is recommended a gluten-free diet to autoimmune thyroiditis patients can be considered.

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