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DIETARY SUPPLEMENTS IN HYPOTHYROIDISM

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ABSTRACT

Background. According to Statistics Poland (GUS, 2021), 15.8% of women and 2.5% of men suffer from thyroid disease. Although pharmacotherapy is the primary treatment, there is evidence that some vitamins and minerals can alleviate the symptoms of thyroid disease. A well-balanced and varied diet should cover the individual demand for energy and all necessary nutrients. However, dietary supplements are prevalent in Poland. This study aims to evaluate the frequency and reasons behind dietary supplementation in patients with hypothyroid diseases.

Material and methods. 232 volunteers (203 women and 29 men) from Poland participated in the research. The research was conducted using a questionnaire. Participants were asked to provide information on their diagnosis, clinical manifestations of the disease, their lifestyles, and the use of dietary supplements with the effect on their health.

Results. The medium age of participants was 27 years. Of them, 85% took dietary supplements. The most popular were vitamin D, magnesium, omega-3 acids, selenium, multivitamins, vitamins B, iron, vitamin C, and zinc. In addition, 53% of patients implemented lifestyle changes after a diagnosis of hypothyroidism. There was a correlation between the participants' age and the willingness to introduce lifestyles modifications: the younger the participants were, the eager they were to introduce modifications ($r = -0.243$, $p = 0.010$, 95% CI: −0.410 to −0.060). In addition, there was a correlation between the participants' age and the willingness to change their diets: the older the participants were, the more eager they were to change diets ($r = 0.283$, $p = 0.003$, 95% CI: 0.103–0.445). Patients indicated numerous health benefits of using dietary supplements. The vitamin D and vitamin and mineral complexes were indicated as the most beneficial.

Conclusion. Dietary supplementation is prevalent in Poland, especially among hypothyroidism patients. Patients take a variety of supplements, claiming that they improve the condition of their skin, nails, memory, and others, which may be controversial. Therefore, it seems advisable to deepen the patients' supplementation knowledge (via contact with a physician, dietitian, etc.). Furthermore, reliable guidelines on supplementation for hypothyroidism patients based on clinical trials should be developed.

Keywords: hypothyroidism, Hashimoto's thyroiditis, dietary supplements, vitamins and trace minerals supplementation

INTRODUCTION

According to Statistics Poland (GUS, 2021), 15.8% of women and 2.5% of men suffer from thyroid disease. The results of studies from 2019 and 2014 indicated significant changes in thyroid diseases, particularly in

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women (increase by 3.7 percentage points). Thyroid diseases are the most common in adults aged 60–69 (13.6%) and 70–79 (15.8%). Hypothyroidism is one of the most common diseases worldwide affecting up to 5% of the population according to European prevalence estimates (Chiovato et al., 2019). It is further estimated that another 5% of the population remains undiagnosed (Chiovato et al., 2019).

The thyroid gland secretes hormones, thyroxine (T4) and triiodothyronine (T3), that play an active part in children's growth and development and regulation of metabolic processes in adults' (Biondi and Cooper, 2019). Hypothyroidism is the result of insufficient production of thyroid hormones or inadequate activity of thyroid hormones in the target tissues (Almandoz and Gharib, 2012). Physicians extinguish two types of hypothyroidism: clinical/overt, in which the TSH is increased, and the T4 levels are low; and subclinical, in which the T4 levels are normal, but the serum TSH is elevated (Almandoz and Gharib, 2012; Biondi and Cooper, 2019). Two major causes of hypothyroidism are iodine deficiency and autoimmune (Hashimoto's) thyroiditis (Biondi and Cooper, 2019). The symptoms of the disease are often subjective and depend on the severity of biochemical hypothyroidism. They are mainly fatigue, cold intolerance, dry skin, constipation, weight gain, vocal changes, and muscle aches (Almandoz and Gharib, 2012; Biondi and Cooper, 2019). In addition, disturbed lipid profile, xerosis, decreased sweating, thickening of the skin, brittle hair, hair loss, oligomenorrhea and menorrhagia are also common (Almandoz and Gharib, 2012). Hypothyroidism is diagnosed on the basis of numerous factors, such as laboratory test results, existing symptoms, family history of thyroid dysfunction, the presence of a goitre or sonographic evidence of thyroid autoimmunity, and also the presence of circulating antithyroid antibodies: anti-TPO, anti-TG, and TSH receptors antibodies (Almandoz and Gharib, 2012; Biondi and Cooper, 2019).

The hypothyroidism is permanent in most patients. Therefore, patients require permanent thyroid hormone replacement (typically synthetic levothyroxine – LT4) (Almandoz and Gharib, 2012).

Although pharmacotherapy is the primary treatment, there is evidence that vitamins and minerals, such as vitamin D, A, E, zinc and selenium, may alleviate the symptoms of thyroid disease (Sworczak and Wiśniewski, 2011; Włochal et al., 2014). A well-balanced and varied diet should cover the individual demand for energy and necessary nutrients (Przysławski et al., 2016). According to Directive 2002/46/EC of the European Parliament and the Council on 10 June 2002, dietary supplements are foodstuffs. Therefore, supplements should only be used if consumers cannot cover their eating requirements from conventional food (Przysławski et al., 2016; Wierzejska et al., 2014). Vitamin deficiencies are rare in healthy subjects in Poland and other developed countries, but many people still take dietary supplements (Sworczak and Wiśniewski, 2011; Wójciak et al., 2019). This study aims to evaluate the frequency and reasons behind dietary supplementation in patients with hypothyroid diseases.

MATERIAL AND METHODS

The study included 232 volunteers (203 women and 29 men) from Poland. The disproportion in sex ratio can be explained by the percentage ratio of thyroid disease in Poland (15.8% of women and 2.5% of men). A questionnaire was used to conduct the study. Participants were asked to provide information on their diagnosis, clinical manifestations of the disease and lifestyles. The questionnaire specifically asked if participants had changed their lifestyle since diagnosis and applied any dietary supplements. They were also asked to assess the influence of dietary supplementation on their health. The questionnaire was comprised of six open clause and eleven close clause questions (single and multiple-choice). The questionnaire was available online on different patients' Facebook groups, forums and websites concerning thyroid diseases. The questionnaire was originally in the Polish language.

The exclusion criteria included being under 18, the lack of diagnosis of hypothyroidism or a hyperthyroid diagnosis. 250 questionnaires were collected in general. However, 10 participants failed to complete the questionnaire and 8 participants were diagnosed with hyperthyroidism. Thus, 232 questionnaires remained.

The obtained data were analysed using MedCalc 19.6 (MedCalc Software, 1993–2020) and

GraphPadPrism 5.01 (GraphPad Software, Inc., La Jolla, CA, USA) statistical software. For all parameters, medians and 1st–3rd quartiles were calculated unless indicated otherwise. The Shapiro-Wilk test was used to check the normality of the data distribution. Statistical differences between groups were tested using Kruskal-Wallis, post-hoc tests (Dunn's multiple comparison test) and Chi^2 for multidimensional contingency tables. The linear correlation between parameters was analysed using Spearman's test. A p-value of <0.05 was considered statistically significant. Statistical analyses were conducted on the basis of descriptive statistics.

RESULTS

Hashimoto thyroiditis was diagnosed in 49% of the 232 hypothyroid participants. In addition, 24% of participants were also diagnosed with other diseases (8% with polycystic ovary syndrome – PCOS, 4% with depression and 2% with insulin resistance). Their medium age was 27 years and 1st to 3rd quartile: 21–38 years. The participants were divided according to their age range: GR1 – up to 30 years, GR2 – 31 to 40 years, GR3 – 41 to 50 years and GR4 – over 51 years.

The most common symptoms that volunteers experienced included dry skin (64%), feeling of cold (58%), constipation (28%), somnolence (26%), fatigue (23%), hair loss (22%), headache (21%) and mood swings (14%).

86% of participants took medications on a regular basis. The most common was levothyroxine – LT4 (93%). Additionally, 85% of patients took dietary supplements. The most popular included vitamin D (98%), magnesium (21%), omega-3 acids (15%), selenium (14%), multivitamins (14%), vitamin B (13%), iron (10%), vitamin C (9%) and zinc (8%). The medium period for supplement taking was 1.5 years (1st–3rd quartile: 2 months, 3.5 years).

As the main source of information on dietary supplements, patients chose websites (74%), physicians (52%), family and friends (46%) and social media (43%). 71% of them took supplements according to leaflet and 33% according to physicians' or pharmacists' guidelines. 74% of participants took supplements every day, 16% irregularly and 11% every other day.

Another question required participants to provide data on lifestyle changes. 53% implemented some changes, 60% began to drink more water, 27% changed their diets and 25% increased physical activity. There was a correlation between the participants' age and the willingness to introduce lifestyles modifications: the younger the participants were, the more eager they were to introduce modifications ($r = -0.243$, $p = 0.010$, 95% CI: −0.410 to −0.060).

70% of participants declared that they ate everything, 9% of patients were on a lactose-free diet, 5% on a gluten-free diet and 4% on the Mediterranean diet. There was a significant difference between the age of participants and dietary modifications ($p < 0.0001$). The differences were found between following groups: GR1 between GR2 and GR4; GR2 and GR3; GR3 and GR4. In addition, there was a correlation between the participants' age and the willingness to change their diets: the older the participants were, the more eager they were to change diets ($r = 0.283$, $p = 0.003$, 95% CI: 0.103–0.445).

In the final part of the questionnaire, patients were asked to indicate whether they had benefited from using any supplements or lifestyle modifications. 52% of participants who took supplements declared that they had health benefits from taking supplements. The results were analysed regarding all patients who took dietary supplements (85% of all respondents, $n = 197$). The detailed results are presented in Table 1.

When it comes to diets, respondents indicated that a lactose-free diet resulted in improved general well-being (57% of all patients on a lactose-free diet), less fatigue (29%), improved memory and concentration (19%) and improved skin condition (19%). Likewise, a gluten-free diet was found to be useful in decreasing TSH level (17% of all patients on a gluten-free diet), improved general well-being (67%), less fatigue (50%), improving hair and nails (33%) and skin (17%) condition, improved memory and concentration (17%), better quality and longer sleep (17%) and alignment of menstrual cycles (17%). Patients on a Mediterranean diet declared no health benefits.

Table 1. Patients declaring beneficial effects of supplementation

Effects	Vitamin D	Vitamins B	Iron	Zinc	Multivitamins	Selenium	Omega-3 acids
	% of patients who took supplements (n = 197)						
↓TSH	7	2	–	4	4	4	2
Less fatigue	35	6	5	2	11	2	–
Improved memory and concentration	17	9	2	2	4	2	13
Improved hair and nails condition	11	11	2	8	16	8	2
Improved skin condition	11	9	–	6	11	4	–
Improved general well-being	25	9	3	2	4	4	8
Better quality and longer sleep	13	4	2	2	4	–	–
Alignment of menstrual cycles	3	2	5	–	6	2	–

DISCUSSION

As per the authors' knowledge, this is the first study to evaluate the use of dietary supplements in patients with hypothyroid diseases in Poland.

Supplements are widely available not only in pharmacies but also in grocery stores, online shops and at petrol stations (Wierzejska et al., 2014). The prevalence of dietary supplements in commercials may give the impression that they are completely safe and do not cause any side effects (Wierzejska et al., 2014). According to Wierzejska (2014), 41.3% of respondents (n = 238) classified supplements as drugs, 47.0% of them used supplements to prevent diseases and 35.6% treated diseases and medical disorders. Przysławski et al. (2016) reported that 52.8% of respondents (n = 401) were unaware that clinical research is not required in the process of registration of a dietary supplement, while only 38.2% were aware that no control of the content of its active substances is required before it is launched on the market. Our research discovered that patients with hypothyroidism frequently utilise nutritional supplements, with vitamin D being the most popular. Vitamin D and vitamin-mineral complexes were indicated as the most effective.

Dietary supplements should be taken temporarily to compensate for vitamin deficiencies in the body and strengthen its functioning (Przysławski et al., 2016). However, in our study, the medium period for supplement taking was 1.5 years. Therefore, patients with hypothyroidism need to be thoroughly examined to determine whether they require such long-term supplementation.

The purpose of taking supplements is usually to enhance the diet with vitamins and minerals to improve the appearance or well-being (Krasnowska and Sikora, 2011). Patients also believe that dietary supplementation boosts vitality, improves mood and enhances the treatment of many disorders (Sworczak and Wiśniewski, 2011). According to Wawryk-Gawda et al. (2018), 20.5% of the healthy respondents reported a significant improvement in their health-related usage of dietary supplements, 51.1% declared a partial improvement in health and 28.5% reported no changes in their health. In our research, 52% of patients claimed improved health. However, our participants suffered from hypothyroidism and often other related diseases.

Vitamin D supplementation was the most popular amongst participants in this study. Kivity et al. (2011) indicated that the vitamin D deficiency was significantly higher in patients with autoimmune thyroid diseases compared to healthy individuals (72.0% vs 30.6%; $p < 0.001$), as well as in patients with Hashimoto's thyroiditis compared to healthy patients (79.0% vs 52.0%; $p < 0.05$). Antithyroid antibodies ($p = 0.01$) and abnormal thyroid function tests ($p = 0.059$) were also linked to vitamin D deficiency. In Chahardoli et al. study (2019), the vitamin D supplementation showed

a significant reduction of anti-Tg Ab and TSH hormone in Hashimoto's thyroiditis. Vitamin D supplementation may help to prevent and treat Hashimoto's thyroiditis (Włochal et al., 2014). However, further research is needed on this topic, especially since many of our patients took vitamin D supplements without knowing their plasma concentration or if they were vitamin D deficient.

According to Erdogan et al. (2012) anaemia prevalence was 43% in the overt hypothyroid group ($n = 100$), 39% in the subclinical hypothyroid group ($n = 100$), and 26% in the control group ($n = 200$; $p = 0.0003$ and $p = 0.021$ respectively related to controls). Hypothyroidism is often associated with anaemia; thus, adding iron to thyroxine therapy can improve patients' condition (Soliman et al., 2017). Despite the relatively high incidence of anaemia, taking iron preparations was not very popular in our study, and it concerned only 10% of the studied patients.

According to Orzechowska et al. (2007), the mean values of B_{12} concentrate in serum in patients with hypothyroidism were significantly lower than the control group (329.69 ±154.37 pg/ml vs 420.83 ±142.07 pg/ml). Following L-thyroxine therapy, plasma total homocysteine significantly decreased as well as the concentration of cobalamin. Therefore, the patients should be screened for vitamin B_{12} deficiency. This deficiency may result in a number of neurologic, psychiatric, haematologic, gastrointestinal and metabolic disturbances (Sworczak and Wiśniewski, 2011). In our study, participants indicated the role of vitamin B supplementation in improving their health, emphasising their beneficial effects in improving the condition of skin, hair and nails.

Zinc is an essential element for converting thyroxine to triiodothyronine (Włochal et al., 2014). In our study, participants indicated the positive effect of zinc supplementation on their health (especially hair condition), but clinical research did not find zinc supplementation in humans without substantial zinc deficiencies leading to regulation of thyroid hormone metabolism (Stolińska and Wolańska, 2012). According to Rabbani et al. (2021) zinc co-supplementation may be beneficial in patients with hypothyroidism. The study showed that zinc, vitamin A, and magnesium supplementation resulted in significant increase in serum FT4 and lower levels of hs-CRP (Rabbani et al., 2021).

Another essential element for proper thyroid functioning is selenium. It is necessary for the thyroid hormone metabolism by conversion of triiodothyronine (T3) to tetraiodothyronine (T4). It also has antioxidant and anti-inflammatory properties (Włochal et al., 2014). In our study, the participants found selenium (Se) to be useful in improving skin, hair and nails' condition. Socha et al. (2012) found that even though the average content of Se in serum of the patients with Hashimoto's disease was significantly lower than healthy subjects, dietary habits had a minor influence on the Se levels in these patients. On the other hand, Se supplementation can reduce serum thyroid peroxidase levels in patients with autoimmune thyroiditis with LT4 treatment (Wichman et al., 2016) or lower or maintain the TSH level in an untreated population decrease the fT4/fT3 ratio (Filipowicz et al., 2021). According to Pirola et al. (2020) supplementation with selenomethionine is associated with normalization of serum TSH levels that is maintained 6 months after selenium withdrawal in 50% of patients with subclinical hypothyroidism due to chronic autoimmune thyroiditis. Thus, selenium supplementation seems reasonable. Despite the lack of official guidelines, European endocrinologists commonly prescribe Se supplements to autoimmune thyroiditis patients. However, proper guidelines on Se supplementation are needed (Filipowicz et al., 2021).

In this study, participants found multivitamins useful in improving their health. On the other hand, patients are rarely aware of possible interactions between nutrients that may result in decreased bioavailability of these nutrients and drug interactions (Przysławski et al., 2016).

Patients with hypothyroidism are often obese, and Hashimoto's disease is associated with inflammation, abnormalities of glucose metabolism and thus increased risk of developing diabetes mellitus type 1 and type 2 (Kawicka et al., 2015). A well-balanced diet is of great importance as it helps to reduce the symptoms of the disease, maintains a healthy weight and prevents the occurrence of malnutrition (Kawicka et al., 2015). In this study, some patients were on gluten-free, lactose-free or Mediterranean diets. Although these diets may positively impact health, the results of clinical studies are inconsistent (Passali et al., 2020; Romano et al., 2017). Patients often do not understand

why they are taking supplements or modifying their lifestyle. In our study, patients reported that a lactose-free diet improved memory, which is controversial. Trends rather than actual indications often dictate the taken supplements and lifestyle changes.

The results obtained in this study are mostly consistent with other experts' research on supplementation in hypothyroidism. However, the research on supplementation is often inconclusive. In addition, the subjective effects of supplementation indicated by patients raise considerable doubts. It may be a placebo effect. Therefore, it seems advisable to broaden patients' knowledge in the field of healthy eating and safe intake of dietary supplements. Recently, there has been a growing interest in nutraceuticals, such as l-carnitine and myo-inositol, and their influence in preventing and treating thyroid diseases (Benvenga et al., 2019). Thus, further clinical research on the effects of supplementation in hypothyroidism patients is required.

CONCLUSIONS

Dietary supplementation is prevalent in Poland, especially in hypothyroidism patients. Patients take a variety of supplements, attributing them effects on improving the condition of the skin, nails, memory and other things, which may be controversial. Therefore, it seems advisable to deepen the patients' knowledge in the field of supplementation (via contact with a physician, dietitian, etc.). Furthermore, reliable guidelines on supplementation for patients with hypothyroidism based on clinical trials should be developed.

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