ORIGINAL PAPER

JMS Journal of Medical Science

Assessment of dietary habits among Polish women with Hashimoto's disease

Kinga Skoracka
Department of Gastroenterology, Dietetics and Internal Medicine, Poznan University of Medical Science, Poland
https://orcid.org/0000-0002-1593-1903
Corresponding author: kingskoracka@gmail.com

Ewelina Swora-Cwynar
Department of Gastroenterology, Dietetics and Internal Medicine, Poznan University of Medical Science, Poland
https://orcid.org/0000-0002-6752-6002

Aleksandra Królczyk
Department of Gastroenterology, Dietetics and Internal Medicine, Poznan University of Medical Science, Poland
https://orcid.org/0000-0001-5006-0421

Małgorzata Kałużna
Department of Endocrinology, Metabolism and Internal Medicine Poznan University of Medical Sciences, Poland
https://orcid.org/0000-0002-2116-4384

Katarzyna Ziemnicka
Department of Endocrinology, Metabolism and Internal Medicine Poznan University of Medical Sciences, Poland
https://orcid.org/0000-0001-5377-8834

Marek Ruchała
Department of Endocrinology, Metabolism and Internal Medicine Poznan University of Medical Sciences, Poland
https://orcid.org/0000-0001-9743-2405

Agnieszka Dobrowolska
Department of Gastroenterology, Dietetics and Internal Medicine, Poznan University of Medical Science, Poland
https://orcid.org/0000-0002-3647-5070

Iwona Krela-Kaźmierczak
Department of Gastroenterology, Dietetics and Internal Medicine, Poznan University of Medical Science, Poland
https://orcid.org/0000-0001-5122-8003

DOI: https://doi.org/10.20883/medical.e735

Keywords: Hashimoto's disease, diet, lifestyle, autoimmune thyroiditis (AIT), Hashimoto's thyroiditis

Received: 2022-09-11
Accepted: 2022-12-28
Published: 2023-03-30

How to Cite: Skoracka K, Swora-Cwynar E, Królczyk A, Kałużna M, Ziemnicka K, Ruchała M, Dobrowolska A, Krela-Kaźmierczak I. Assessment of dietary habits among Polish women with Hashimoto's disease. Journal of Medical Science. 2023;92(1);e568. doi:10.20883/medical.e735

ABSTRACT

Introduction. Selected dietary components are crucial for a properly functioning thyroid gland. Therefore a healthy and balanced diet is crucial for treating patients with Hashimoto's disease.
Aim. This study aims to evaluate the dietary habits of women suffering from autoimmune thyroiditis.
Material and methods. A questionnaire study was conducted in a group of 58 women with Hashimoto's disease and among 42 women without autoimmune thyroiditis using the Food Frequency Questionnaire (FFQ-6). To assess compliance with the normal distribution, we used the Shapiro-Wilk test. The comparative assessment was made using the Student's t-test and Mann-Whitney test. The Chi-square test was used to assess the relationship between the response and the group. A p-value of less than 0.05 was considered significant.
Results. The study showed no significant differences in dietary habits between the two groups. Only 29% (n = 15) of women with HT declared daily consumption of fruits vs 31% (n = 12) in the control group (p = 0.3800), and only 2% (n = 1) declared consuming berries daily vs. 5% (n = 2), (p = 0.5270). The consump-

tion of the recommended several portions of vegetables per day was declared by only 22% (n = 11) of women with HT vs 28% (n = 11) in the control group (p = 0.3983). 42% (n = 24) of women with HT vs 38.5% (n = 16) of controls reported eating cruciferous vegetables several times a week (p = 0.8241). 14% (n = 8) of women with HT vs 19% (n = 8) of women in the control group declared daily consumption of green leafy vegetables (p = 0.3653). Most people in the study group consume nuts and seeds several times a month, and those in the control group several times a week. Most HT respondents also declare not to consume the recommended amount of fish.

Conclusions. The diet of patients with Hashimoto's disease does not differ significantly from that of non-Hashimoto's disease patients. Considering the study results and current scientific knowledge, it seems necessary to undertake educational activities for patients with Hashimoto's disease to increase patient awareness of the impact of diet on the course of the disease.

Introduction

Hashimoto's disease (HT, Hashimoto's Thyroiditis) is the most common chronic autoimmune disease in iodine-sufficient areas. HT is characterized by the presence of autoantibodies directed against thyroid peroxidase (anti-TPO) and thyroglobulin (anti-TG), elevated thyrotropic hormone (TSH) levels, and often reduced levels of free thyroxine (fT4) and sometimes free triiodothyronine (fT3). An ultrasound image of the thyroid gland shows lymphocytic T- and B-cell infiltration, fibrosis, and hypoechoic parenchyma [1, 2]. Occasionally, a thyroid goiter is also present, but in most cases a reduction in thyroid size is observed. Treatment of HT is mainly based on synthetic thyroid hormone therapy [3].

For the development of HT is responsible a complex autoimmune process involving thyroid cells through a chain reaction. Pathogenic mechanisms that may lead to the development of Hashimoto's disease include impaired function of regulatory T cells (Treg, T regulatory cells), which are responsible for inhibiting excessive anti-inflammatory response and protecting the organism from autoimmunity. Possible pathomechanism is also an increase in the activity of follicular helper T cells (Tfh) involved in stimulating the production of B lymphocytes, by increasing the production of interleukin-21 (IL-21). Furthermore, DNA fragments released after cell apoptosis and an altered microRNA profile are thought to initiate and perpetuate the autoimmune process. Infiltrating thyroid T and B lymphocytes show a cytotoxic effect on the cell, leading it to apoptosis and, consequently, to the production of antibodies and increased production of inflammatory cytokines [4].

Among the genes involved in the development of HT, the mainly mentioned are the tissue compatibility system (HLA, Human Leukocyte Antigen) and polymorphisms in the cytotoxic T-lymphocyte antigen 4 (CTLA-4) gene, as well as in the PTPN22, CD14, CD40 and IL2R genes [5]. However, Jabrocka-Hybel et al. in a study on 147 HT patients and 147 healthy individuals, showed that the genetic predisposition factors used for HT development, without taking into account environmental and personal factors, are not sufficient to predict the actual risk of HT [6].

Epidemiological observations show an increasing trend in the incidence of HT since the 1950s. Previously, few cases of the disease were reported, whereas today HT is the most common autoimmune disorder. These observations confirm that, in addition to genetic factors, environmental factors have a huge impact on the development of the disease. Environmental factors include dietary errors, including excessive iodine intake and selenium deficiency, infections, especially hepatitis C, excessive environmental hygiene, stress, certain drugs, cytokine therapies, and lithium salts [7, 8]. Factors predisposing to the development of HT also include the influence of oxidative stress, climate, age, and sex. The initiating effect of an autoimmune response in the thyroid gland has also been attributed to pregnancy [2, 7]. Interestingly, it has been observed that cigarette smoking and moderate alcohol consumption show a protective effect against the development of Hashimoto's disease [8].

In countries where mandatory iodine fortification of food has been introduced for the prevention of diseases caused by an insufficient iodine supply, the incidence of HT has increased, where-

as, in countries with an insufficient iodine supply, HT cases are observed less frequently [9].

Mechanisms explaining why excessive iodine intake may predispose to HT include modification of thyroglobulin at the epigenetic level, resulting in the production of a factor to which the immune system has not yet developed immune tolerance, and excessive induction of apoptosis of thyroid cells, resulting in the release of large numbers of T lymphocytes involved in the autoimmune response [8].

On the other hand insufficient dietary selenium supply is associated with a decrease in the activity of glutathione peroxidase (GPx), thioredoxin reductase (TRx), or iodothyronine deiodase (DIO). Decreased GPx activity is associated with increased production of hydrogen peroxide and thyroid peroxidase, resulting in the destruction of thyroid cells. GPx and TRx have antioxidant activity, so selenium deficiency contributes to a decrease in protective capacity against oxidative stress [8]. Deiodinases are responsible for the conversion of T4 to T3. Selenium can also regulate T lymphocytes, resulting in increased immune tolerance, and has an anti-inflammatory effect. Furthermore, selenium can inhibit the expression of HLA-DR molecules on thyrocytes, suppressing thyroid autoimmunity [9].

It is also worth paying attention to an adequate iron supply due to its significant role in the production of the thyroid hormones T3 and T4 – the enzyme TPO, which is involved in the synthesis of thyroid hormones, is only activated after heme binding [10]. Iron deficiency, which reduces the activity of the TPO enzyme, is more common in HT patients than in the healthy population [9]. Furthermore, it has been suggested that, through its effect on the immune system, also vitamin D may be involved in regulating thyroid function, but research in this area is conflicting [9].

Furthermore, there is an interest in elimination diets, e.g. gluten-free and lactose-free diets, among HT patients. Lactose intolerance is diagnosed in up to 75.9% of HT patients, and 5.9–22.5% of HT patients have positive CD-related autoantibodies [11].

Aim

The aim of this study was to assess eating habits in patients with HT.

Material and methods

We included 58 women with HT in the study group, and 42 women without HT, who were classified as controls. Data were collected from November 2019 to January 2021. A validated Food Frequency Questionnaire (FFQ-6) was used to assess dietary intake, allowing the collection of information on the frequency of consumption of 62 food groups, which simultaneously identifies the intake of 8 main food groups consumed over the preceding 12 months of questionnaire completion. The respondents could declare frequency of consumption by choosing one of the following answers: several times a day, every day, several times a week, several times a month, once a month or less often, never, or almost never.

The inclusion criteria for the study group were female sex and a diagnosis of Hashimoto's disease based on ultrasound and antibody testing. For the control group, the inclusion criteria were: female sex, and no Hashimoto's disease.

Before entering the study, each participant was asked to give written informed consent to participate in the study. Patients were informed that they could withdraw from the study at any stage. All data remained anonymous – each participant was given an anonymous number, which was used in analyses at further stages of the study.

The obtained results of the study were collected in the form of a database with the help of Microsoft Excel. Statistical analyses were carried out using Dell Statistica software. Qualitative data were presented in quantitative and percentage terms. The Shapiro-Wilk test was used to assess the concordance of the thyroid parameters studied with a normal distribution; a comparative assessment of the parameters and selected variables between the control group and the study group was performed using the Student's t-test and the Mann-Whitney test. The Chi-square test was used to assess the relationship between response and group. A p-value of less than 0.05 was considered significant.

The study was approved by the Bioethics Committee at the Poznan University of Medical Sciences (Poland) No. 69/19.

Results

A total of 100 women were enrolled in the study, where 58 women diagnosed with HT were included in the study group, and 42 women not suffering from HT were included in the control group. The mean age of the women in the study group was 31 ± 6.92 years and in the control group the mean age was 29 ± 6.47 years. The characteristics of the thyroid parameters of the study participants are shown in **Table 1**.

We found no statistically significant differences in diet between the group of female patients with Hashimoto's disease and the control group. When asked about the frequency of fruit consumption, the female participants most frequently answered that they consumed fruit several times a week – this answer was given by 44% of the study group and 33% of the control group, respectively, and daily consumption was declared by 29% of the study group and 31% of the control group. However, there was no correlation between responses and group (p = 0.3800). Detailed results are shown in **Figure 1**.

The majority of female patients in both groups reported consuming berries several times a month or once a month and less frequently. There was no correlation between responses and group (p = 0.5270). Detailed results are shown in **Figure 2**.

Most women in the study group declared to consume vegetables several times a week and daily, while in the control group it was daily and several times a day. There was no correlation between responses and group (p = 0.3983). The results are presented in **Figure 3**.

In both groups, most participants reported consuming vegetables several times a week and several times a month. There was no correlation between responses and group (p = 0.8241). The results are shown in **Figure 4**.

Most women in the study group report consuming leafy vegetables several times a week, and those in the control group several times a month. There was no correlation between responses and group (p = 0.3653). The results are shown in **Figure 5**.

None of the respondents declared eating legumes several times a day. The most frequent answer in both groups was once a month or less often. There was no correlation between responses and group (p = 0.8574). The results are shown in **Figure 6**.

Most women with HT report consuming seeds and grains a few times a week, with the next most frequently chosen answers being a few times a month and never or almost never. In contrast, in the control group, the most frequently selected answer was a few times a month. There was no correlation between responses and group (p = 0.3299). The results are presented in **Figure 7**.

None of the respondents declared to eat oily fish several times a day or every day. The most frequent answer given in both groups was never or almost never. There was no correlation between responses and group (p = 0.8995). The results are shown in **Figure 8**.

Similarly, none of the respondents declared to consume lean fish several times a day or every day. The most frequent answer given was once a month or less often, and in the control group also several times a month. There was no correlation between responses and group (p = 0.9679). The results are shown in **Figure 9**.

Table 1. Comparison of thyroid panel parameters between groups.

Parameter	Group	Mean	SD	p
TSH [uU/ml]	study	2.76	3.42	p = 0.7
	control	2.41	0.99	
fT3 [pmol/l]	study	4.89	0.77	p = 0.05
	control	5.25	0.72	
fT4 [pmol/l]	study	17.04	3.41	p = 0.002
	control	15.13	1.90	
anty-TPO [IU/ml]	study	155.86	149.50	p < 0.0001
	control	9.32	2.59	
anty-TG [IU/ml]	study	348.45	531.25	p < 0.0001
	control	15.24	11.91	

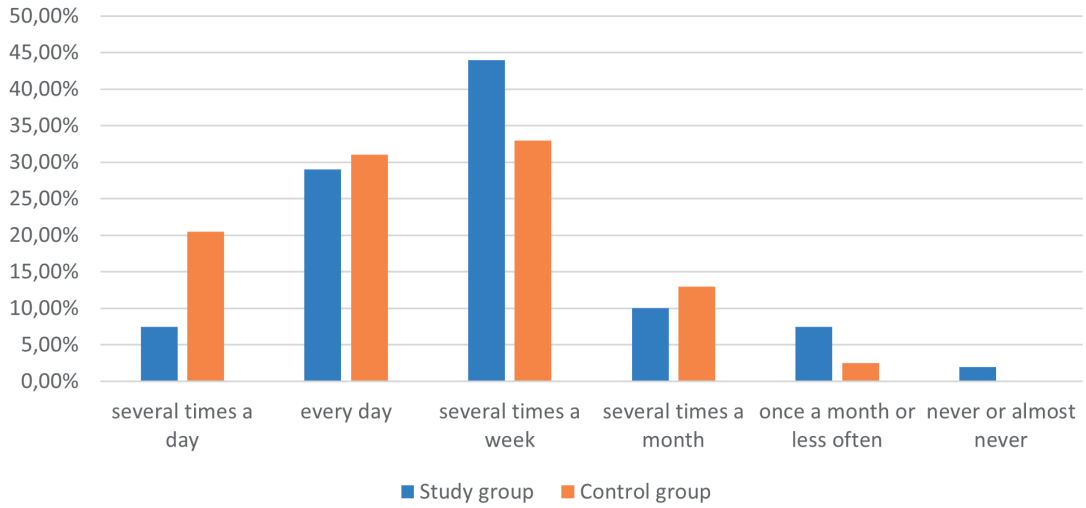

Figure 1. How often in the last 12 months have you drunk or eaten fruits, all types?

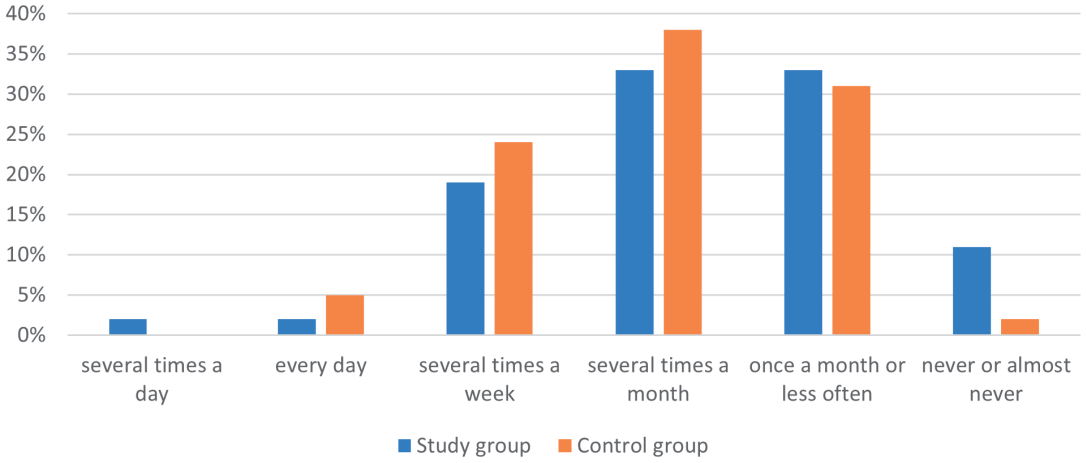

Figure 2. In the last 12 months, how often did you drink or eat berries: strawberries, raspberries, blackberries, blueberries, currants?

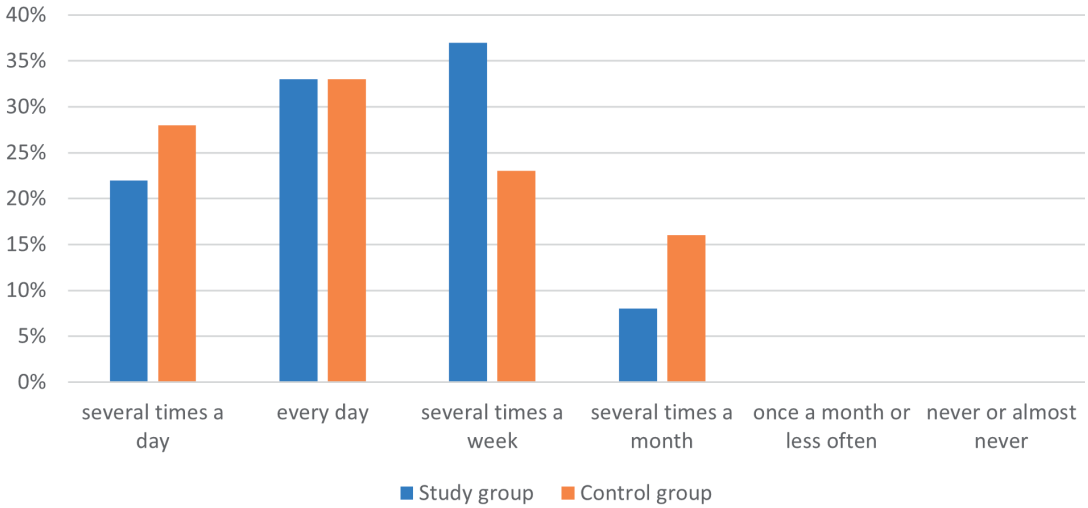

Figure 3. In the last 12 months, how often have you drunk or eaten vegetables, all types?

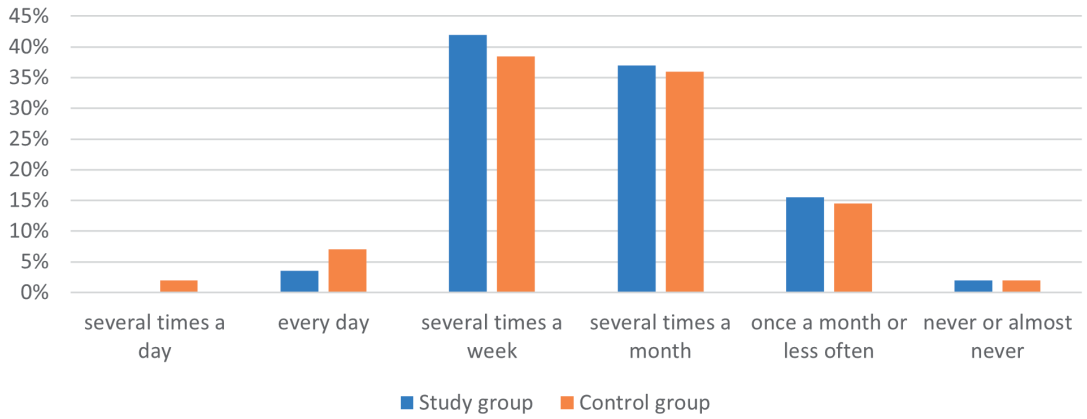

Figure 4. In the last 12 months, how often did you drink or eat cruciferous vegetables: white cabbage, Italian cabbage, red cabbage, Chinese cabbage, brussels sprouts, cauliflower, broccoli, kale?

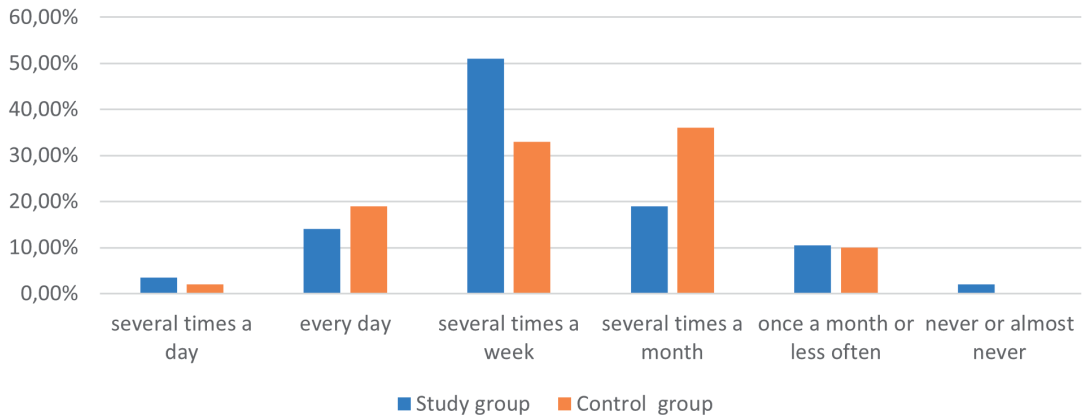

Figure 5. In the last 12 months, how often did you drink or eat leafy green vegetables: spinach, radicchio, butter lettuce, iceberg lettuce, romaine lettuce, rocket, leeks, celery, parsley leaves?

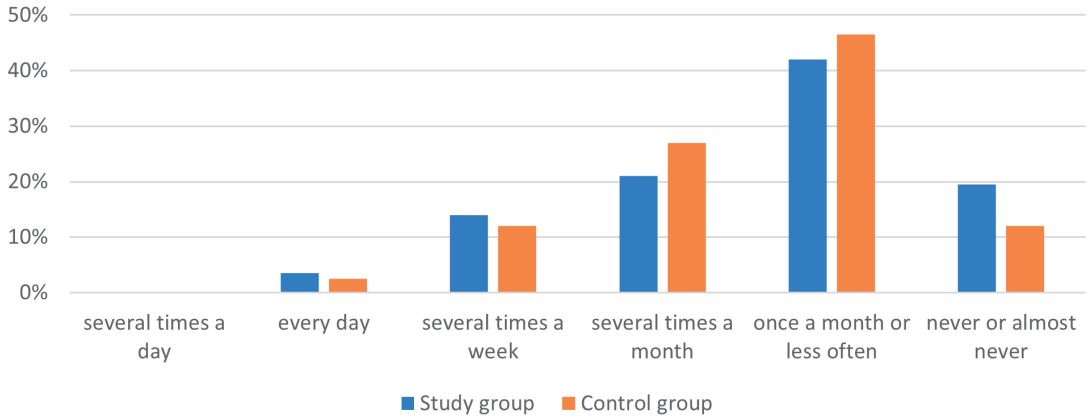

Figure 6. In the last 12 months, how often did you drink or eat dry pulses e.g. broad beans, beans, soya, peas, chickpeas, and in dishes e.g. pea soup, baked beans, hummus and other pastes?

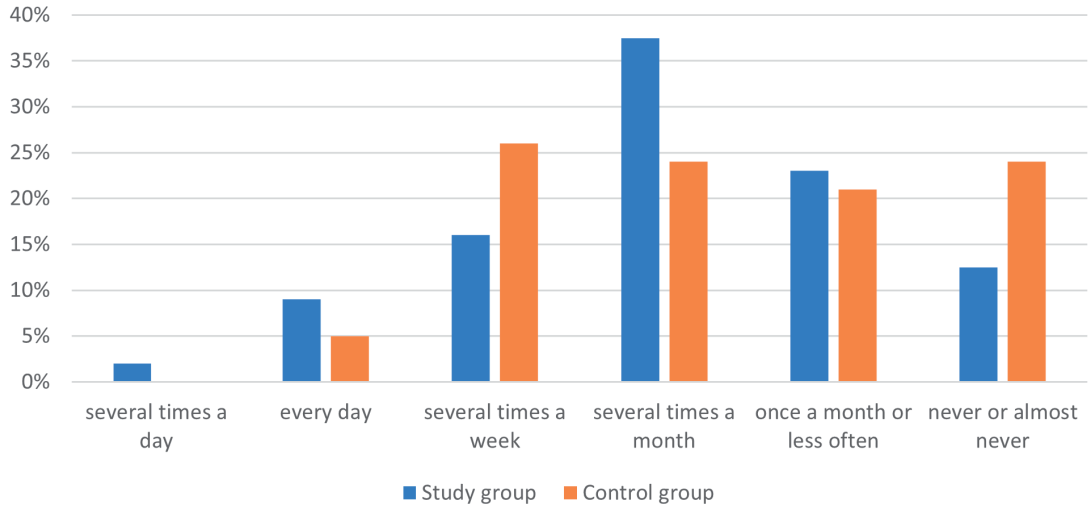

Figure 7. In the last 12 months, how often did you drink or eat grains, e.g. pumpkin, sesame, sunflower, wheat germ?

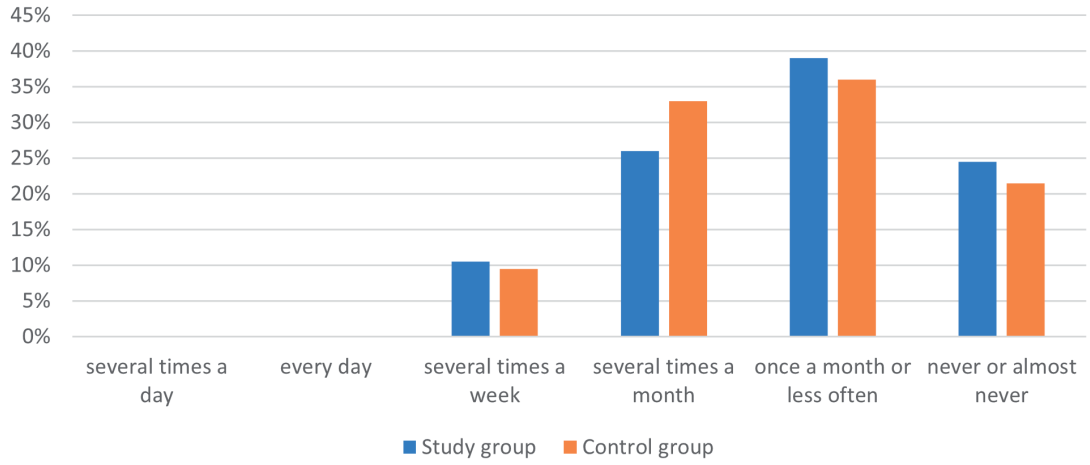

Figure 8. In the last 12 months, how often did you drink or eat oily fish, e.g. salmon, sardines, herring, mackerel, large carp, eel?

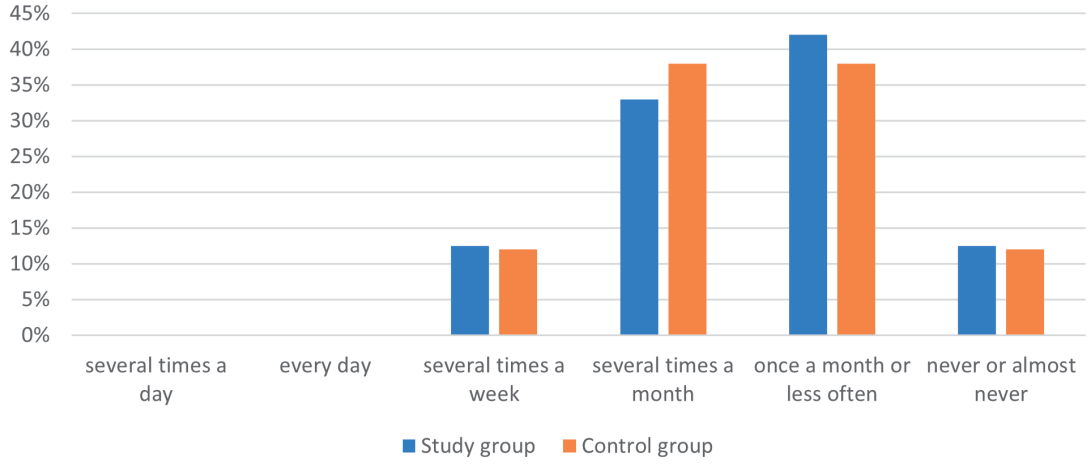

Figure 9. In the last 12 months, how often did you drink or eat lean fish, e.g. pollock, cod, perch, hake, carp up to 1 kg, tuna, panga, trout?

Discussion

An adequate diet seems to be an important part of the therapeutic management of patients with HT. However, our study showed no statistically significant differences between the diets of HT and control patients. Only 7.5% of women with HT declared that they consumed fruit several times a day, and 29% daily. Few subjects declared sufficient intake of berries, which have a high antioxidant potential – 2% of HT subjects declared consuming berries daily and 19% several times a week. In contrast, the consumption of the recommended several portions of vegetables per day was declared by only 22% of those with HT. Interestingly, no statistical differences were observed in the level of intake of cruciferous vegetables between the two groups. There is a popular myth that people with hypothyroidism should not consume cruciferous vegetables because of the goitrogens they contain, which can disrupt thyroid function by binding iodine used in the production of thyroid hormones. However, it should be emphasized that the consumption of cruciferous vegetables in moderation does not adversely affect the thyroid gland and that the adverse effects of goitrogens may only become apparent with a concomitant insufficient supply of iodine. Furthermore, heat processing of food eliminates a significant proportion of goitrogenic substances [13].

It is therefore a positive result that, in the study, 43% of women with HT report eating cruciferous vegetables several times a week. Cruciferous vegetables are a rich source of bioactive substances with anticancer effects.

About half of women with HT declare that they consume green leafy vegetables several times a week, but less than 19% consume them daily. Legumes are most often consumed once a month or less often by 42% of the people in the study group and 46.5% of the control group. Only 2 people in the study group and 1 person in the control group declared to consume legumes daily.

In contrast, nuts and seeds are consumed several times a month by most people in the study group and several times a week by those in the control group.

The majority of HT respondents also declare not consuming the recommended amount of fish – almost 25% of female respondents answered that they never consume oily fish and 39% answered that they consume it once a month or less often. Similarly, lean fish – 33% of respondents consume it several times a month, 42% once a month or less often, and 13% never or almost never.

Table 2. Nutritional sources of dietary components important for proper thyroid functioning [12, 20].

Nutrient	Dietary sources	Requirements for adult women
Iodine	milk and dairy products, fish and seafood and eggs iodised salt	150 µg/day, 220 µg/day for pregnant women and 290 µg/day for breastfeeding women
Selenium	offal, especially kidney, sea food: shellfish and fish, milk and milk products, garlic, mushrooms, dry pulses	55 µg/day, 60 µg/day for pregnant women and 70 µg/day for breastfeeding women
Iron	meat, fish, cereals, beans, nuts, egg yolks, dark green vegetables, potatoes and fortified foods	18 mg/day for women aged 19–50 years, 10 mg/day after 50 years old, 27 mg/day for pregnant women and 10 mg/day for breastfeeding women
Zinc	meat, liver, rennet cheeses, brown bread, buckwheat, eggs	8 mg/day for women, 11 mg/day for pregnant women and 12 mg/day for breastfeeding women
Vitamin D	fatty fish, eggs, milk and milk products, fortified margarine – only 20% of the body's vitamin D pool is obtained from the diet	15 µg cholecalciferol/day at a sufficient intake level
Vitamin C	parsley, black currants, kiwi fruit, red pepper, cruciferous vegetables, strawberries, citrus fruits	75 mg/day for women, 85 mg/day for pregnant women, and 120 mg/day for breastfeeding women
Vitamin E	wheat germ oil, sunflower oil, safflower oil, cereal products, nuts, vegetables, meat, and dairy products	8 mg tocopherol/day, 10 mg/day for pregnant women, 11 mg/day for breastfeeding women
Vitamin A	β-carotene: carrots, parsley, spinach, kale, broccoli, apricots, peaches retinol: offal, especially in liver, eggs, rennet ripening cheese, butter and some sea fish	700 µg retinol equivalent/day, 770 µg retinol equivalent/day for pregnant women, 1300 µg retinol equivalent/day for breastfeeding women

Both green leafy vegetables and oily marine fish are part of the anti-inflammatory diet recommended for people with HT. Green leafy vegetables are a source of antioxidant micronutrients and oily marine fish are a source of highly anti-inflammatory omega-3 fatty acids. Also, lean fish is a source of iodine and selenium which are important dietary components for people with thyroid disease [13].

An interesting study was conducted by Omeljaniuk et al. on a group of 101 women aged 17–68 years with diagnosed Hashimoto's disease, living in the areas of Białystok, Kętrzyn and Zambrów. It was observed that the diets of the studied women were characterized by an insufficient energy supply, a low content of fats and dietary fiber, and, in turn, an excess of protein and digestible carbohydrates [14].

Kaličanin et al. in a study designed to demonstrate dietary differences between a group of 491 patients with HT and a group of 433 patients without thyroid disease, observed that patients with HT consumed higher amounts of animal fats and processed meat, as well as nuts compared to controls. In contrast, they were less likely to consume red meat, soft drinks, whole grain products, vegetable oil, olive oil, alcohol, fatty fish and fruit. Furthermore, researchers have shown that patients don't tend to change their eating habits after HT diagnosis [15].

A gluten-free diet has gained considerable popularity among people with HT. Celiac disease, an indication for adherence to a strict gluten-free diet, is diagnosed in HT patients up to 10 times more frequently than in the healthy population [11]. Some researchers suggest that gliadin, a component of gluten, triggers an immune system response that targets not only gliadin but also the thyroid gland [3]. Malabsorption is also a common symptom of celiac disease, and as a result, deficiencies of the key elements for thyroid function – iodine and selenium – can occur. Additionally, an improperly managed gluten-free diet is very often a deficiency diet [16].

Krysiak et al. conducted a study on a group of 34 women aged 20–45 years with newly diagnosed HT in a euthyroid state, not taking levothyroxine. The women were divided into two groups, group A and group B. Women in group A were put on a gluten-free diet for 6 months, while no dietary modifications were made in group B. After 6 months, it was observed that anti-TPO and anti-TG antibody levels decreased in women following the gluten-free diet. A slight increase in vitamin D3 levels was also observed compared to control subjects. The researchers suggest that a gluten-free diet may be of clinical benefit to euthyroid women with Hashimoto's thyroiditis, who are at high risk of developing hypothyroidism due to significantly elevated anti-thyroid antibodies [18].

On the other hand, Poblocki et al. on a group of 62 women with HT aged 18–55 years assessed the effect of a gluten-free diet on TSH, fT3, fT4, anti-TPO, and anti-TG levels after 3, 6 and 12 months. The women were taking levothyroxine and celiac disease was excluded. The researchers showed that eliminating gluten from the diet of HT patients led to lower TSH levels and increased fT4 levels compared to the control group, suggesting that a gluten-free diet may improve intestinal absorption of levothyroxine. However, no differences were seen in anti-TPO and anti-TG concentrations in both groups. The researchers also note that patients enrolled in the study group were educated on how to properly compose a healthy and balanced gluten-free diet by a qualified dietitian. Therefore, it is worth considering whether dietary education influenced the change of eating habits to healthier ones in patients from the study group [17].

In the light of current research, POLSPEN recommends the introduction of a gluten-free diet only in HT patients with coexisting coeliac disease. Thus, in the light of the current study, there is no indication to introduce a gluten-free diet in patients with HT. However, it is worth considering diagnostic testing for coeliac disease in HT patients due to the frequent co-occurrence of autoimmune diseases [19].

Also, lactose elimination is only recommended in patients with HT and coexisting lactose intolerance. Consumption of lactose by those with lactose intolerance reduces the bioavailability of levothyroxine [3]. Given the high prevalence of lactose intolerance, it is suggested that patients with HT, especially those presenting with specific symptoms, should be diagnosed for lactose intolerance [11].

The diet of people with HT should be based on the principles of healthy nutrition for the healthy population, but there is no universal diet for all HT patients. It is extremely important to individu-

alize dietary recommendations based on detailed health and nutritional history. Dietary factors affect thyroid function and hormone secretion mainly by influencing the hypothalamic-pituitary-thyroid-peripheral tissue axis. Diet can also influence inflammatory processes in the thyroid gland. The diet should therefore be rich in nutrient-dense foods to ensure proper synthesis and secretion of thyroid hormones, as well as in foods with high antioxidant and anti-inflammatory potential to give the diet an anti-inflammatory character. The diet shall be correctly composed in terms of energy, fatty acids, protein and carbohydrate content, as well as vitamins and minerals. Special attention should be paid to iodine, selenium, iron, as well as zinc, and vitamins A, D, E, and vitamin C [12].

Conclusions

The diet of patients with Hashimoto's disease does not differ significantly from that of non-Hashimoto's disease patients. Taking into account the results of the study and current scientific knowledge, we believe that it is advisable to undertake educational activities for patients with Hashimoto's disease in order to increase patient awareness of the impact of diet on the course of the disease.

Based on current scientific reports [3, 9, 11], the most important dietary recommendations for Hashimoto's patients are as follows:

1. Consume 4–5 regular, properly composed meals.
2. Ensure adequate intake of key vitamins and minerals: especially iodine, selenium, iron, vitamin D, as well as zinc, vitamin A, C and E.
3. Match the energy value of your diet to your lifestyle, health, sex, and age – both low-calorie and high-calorie diets can affect thyroid function by increasing TSH if the diet is too high in energy and decreasing fT3 levels if the diet is too low in energy.
4. Increase protein supply to 15–20% and in some cases up to 20–25% of daily energy intake.
5. Include sources of complex carbohydrates in the diet in the form of whole-grain and high-fibre products, especially with co-morbid carbohydrate imbalances and co-occurring constipation. Minimise the intake of simple sugars and eat more vegetables and fruit instead.
6. Ensure adequate quantity and quality of fats in the diet. Increase your intake of unsaturated fats from plant products, e.g. olive oil, rapeseed oil, linseed oil, nuts and seeds, and omega-3 fatty acids from oily marine fish.
7. Avoid elimination diets if not indicated.

Acknowledgements

Conflict of interest statement
The authors declare no conflict of interest.

Funding sources
There are no sources of funding to declare.

References

1. Mincer, D.L.; Jialal, I. Hashimoto Thyroiditis. In StatPearls; StatPearls Publishing: Treasure Island (FL), 2021.
2. Wu, G.; Zou, D.; Cai, H.; Liu, Y. Ultrasonography in the Diagnosis of Hashimoto's Thyroiditis. Front Biosci (Landmark Ed) 2016, 21, 1006–1012, doi:10.2741/4437.
3. Ratajczak, A.E.; Moszak, M.; Grzymisławski, M. Dietary Recommendations for Hypothyroidism and Hashimoto's Disease. Pielęgniarstwo i Zdrowie Publiczne Nursing and Public Health 2017, 7, 305–311, doi:10.17219/pzp/76716.
4. Ajjan, R.A.; Weetman, A.P. The Pathogenesis of Hashimoto's Thyroiditis: Further Developments in Our Understanding. Horm Metab Res 2015, 47, 702–710, doi:10.1055/s-0035–1548832.
5. Jia, X.; Wang, B.; Yao, Q.; Li, Q.; Zhang, J. Variations in CD14 Gene Are Associated With Autoimmune Thyroid Diseases in the Chinese Population. Front Endocrinol (Lausanne) 2019, 9, 811, doi:10.3389/fendo.2018.00811.
6. Jabrocka-Hybel, A.; Skalniak, A.; Piątkowski, J.; Turek-Jabrocka, R.; Vyhouskaya, P.; Ludwig-Słomczyńska, A.; Machlowska, J.; Kapusta, P.; Małecki, M.; Pach, D.; et al. How Much of the Predisposition to Hashimoto's Thyroiditis Can Be Explained Based on Previously Reported Associations? J Endocrinol Invest 2018, 41, 1409–1416, doi:10.1007/s40618–018–0910–4.
7. Hiromatsu, Y.; Satoh, H.; Amino, N. Hashimoto's Thyroiditis: History and Future Outlook. Hormones (Athens) 2013, 12, 12–18, doi:10.1007/BF03401282.
8. Choroba Hashimoto – Aspekt Genetyczny i Środowiskowy – Luty – Forum Medycyny Rodzinnej Available online: https://journals.viamedica.pl/forum_medycyny_rodzinnej/article/view/51240 (accessed on 8 June 2021).
9. Hu, S.; Rayman, M.P. Multiple Nutritional Factors and the Risk of Hashimoto's Thyroiditis. Thyroid 2017, 27, 597–610, doi:10.1089/thy.2016.0635.
10. Rayman, M.P. Multiple Nutritional Factors and Thyroid Disease, with Particular Reference to Autoim-

mune Thyroid Disease. Proc Nutr Soc 2019, 78, 34–44, doi:10.1017/S0029665118001192.
11. Ihnatowicz, P.; Drywień, M.; Wątor, P.; Wojsiat, J. The Importance of Nutritional Factors and Dietary Management of Hashimoto's Thyroiditis. Ann Agric Environ Med. 2020, 27, 184–193, doi:10.26444/aaem/112331.
12. Lachowicz, K.; Stachoń, M.; Pałkowska-Goździk, E.; Lange, E. Fizjologiczne aspekty postępowania dietetycznego w chorobie Hashimoto. Kosmos 2019, 68, 201–214, doi:10.36921/kos.2019_2545.
13. Pastusiak, K.; Michałowska, J.; Bogdański, P. Postępowanie dietetyczne w chorobach tarczycy. Forum Zaburzeń Metabolicznych 2017, 8, 155–160.
14. Omeljaniuk, W.J.; Dziemianowicz, M.; Naliwajko, S.K.; Bartosiuk, E.; Markiewicz-Zukowska, R.; Borawska, M.H. Ocena sposobu żywienia pacjentek z chorobą Hashimoto. Bromatologia i Chemia Toksykologiczna 2011, 44.
15. Kaličanin, D.; Brčić, L.; Ljubetić, K.; Barić, A.; Gračan, S.; Brekalo, M.; Torlak Lovrić, V.; Kolčić, I.; Polašek, O.; Zemunik, T.; et al. Differences in Food Consumption between Patients with Hashimoto's Thyroiditis and Healthy Individuals. Sci Rep 2020, 10, 10670, doi:10.1038/s41598–020–67719–7.
16. Liontiris, M.I.; Mazokopakis, E.E. A Concise Review of Hashimoto Thyroiditis (HT) and the Importance of Iodine, Selenium, Vitamin D and Gluten on the Autoimmunity and Dietary Management of HT Patients.Points That Need More Investigation. 6.
17. Pobłocki, J.; Pańka, T.; Szczuko, M.; Telesiński, A.; Syrenicz, A. Whether a Gluten-Free Diet Should Be Recommended in Chronic Autoimmune Thyroiditis or Not?—A 12-Month Follow-Up. J Clin Med 2021, 10, 3240, doi:10.3390/jcm10153240.
18. Krysiak, R.; Szkróbka, W.; Okopień, B. The Effect of Gluten-Free Diet on Thyroid Autoimmunity in Drug-Naïve Women with Hashimoto's Thyroiditis: A Pilot Study. Exp Clin Endocrinol Diabetes 2019, 127, 417–422, doi:10.1055/a-0653–7108.
19. Ch'ng, C.L.; Jones, M.K.; Kingham, J.G.C. Celiac Disease and Autoimmune Thyroid Disease. Clin Med Res 2007, 5, 184–192, doi:10.3121/cmr.2007.738.
20. Jarosz, M.; Rychlik, E.; Stoś, K.; Wierzejska, R.; Wojtasik, A.; Charzewska, J.; Mojska, H.; Szponar, L.; Sajór, I.; Kłosiewicz-Latoszek, L.; et al. Normy żywienia dla populacji Polski; Instytut Żywności i Żywienia: Warszawa, 2017; ISBN 978–83–86060–89–4.