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RESEARCH ON DIET FEATURES OF PATIENTS WITH HYPOTHYROIDISM

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Studies on the relationship between dietary features and hypothyroidism pathogenesis are highly relevant. The aim of this research was to study the dietary features of patients with hypothyroidism and to determine the possible impact of patients' food preferences on the pathogenesis of hypothyroidism. We examined 400 women of Polish nationality aged 19-28 years living in the district of Biała Podlaski of the Lublin Voivodeship of Poland who consider themselves healthy. Blood levels of free (FT3) and total (T3) triiodothyronine, free (FT4) and total (T4) thyroxine, thyroid-stimulating hormone (TSH) were determined. The quantitative and qualitative composition of the examined women's diet was determined using questionnaires and nutritional tables. It was revealed, that the prevalence of hypothyroidism among the female subjects was 3.5%. Women with reduced thyroid function were shown to consume 3.78 times less iodine, 2.97 times ($P < 0.001$) less sodium chloride (table salt), and 1.47 times ($P < 0.001$) less proteins than those who had normal thyroid function. In addition, women with hypothyroidism consume 2.25 times ($P < 0.001$) more strumogens. It is concluded that the use of such the diet could cause a secondary reduction in thyroid function with further development of the hypothyroidism.

K e y w o r d s: hypothyroidism, triiodothyronine, thyroxine, thyroid-stimulating hormone. hypocaloric diet, iodine.

Iodine is a key trace element of the environment, which is indispensable for the normal functioning of the human body. The formation of thyroid gland hormones (TGH) occurs with its participation, it is part of their composition. Data on the epidemiology of hypothyroidism differ from one researcher to another. The reason for such distinctions is probably the fact that the studies covered geographically different regions with the various ethnic composition of the surveyed [1, 2]. According to Taylor P.N. et al. [3], new studies on the prevalence of disease (TG) depending on the geographical location and ethnic composition of the examined patients are relevant since they provide an opportunity to reveal the true picture of the morbidity.

Zimmermann M.B. [4] considers the researches on the relationship between environmental factors, in particular iodine content in food, and the epidemiology of hypo- and hyperthyroidism to be very important. The data of Hahn P. and Baumgartner C. et al., demonstrate the possible role of the consumption of products with strumogens properties (TG hormone antagonists) and unbalanced diet in the pathogenesis of hypothyroidism [5, 6].

The aim of this research was to establish a connection between diet features and reduced thyroid function in women in Eastern Poland.

Materials and Methods

We examined 400 women of Polish nationality aged 19-28 who live in the Biała Podlaska County

of the Lublin Voivodeship of Poland and consider themselves healthy.

Inclusion criteria: female; aged over 19 years; no symptoms of internal organs diseases at the time of the examination; absence of chronic diseases of internal organs in the anamnesis.

Exclusion criteria: detection of hyperthyroidism, including autoimmune thyroiditis in the thyrotoxic phase.

The blood levels of free (FT3) and total (T3) triiodothyronine, free (FT4) and total (T4) thyroxin, thyroid-stimulating hormone (TSH) and the level of antibodies to thyroid peroxidase were determined. Questionnaires and food tables were used to determine the approximate average amount of proteins, fats and carbohydrates in the daily diet, as well as the average daily intake of iodine and products with strumogen properties [7-9]. The subjects, whose laboratory tests indicated hypothyroidism, formed one group. The results of the examinations of patients with euthyroidism were numbered, then the same number of examinations as those of patients with hypothyroidism were selected using a random number generator. These examinees formed the second group. Women with hypothyroidism were unaware of its existence prior to the examination and had not taken any medication to correct it.

All patients gave informed consent to participate in the study. The results of the research were planned and approved by the Bioethical Commission of Pope John Paul II State School of Higher Education in Biała Podlaska.

Results and Discussion

Changes in hormone levels typical for hypothyroidism, specifically a decrease in the levels of FT3, T3, FT4 and T4 with an increase in the TSH content, were observed in 14 patients, representing 3.5% of the total number of patients. Euthyroidism was observed in 374 patients or 93.5% of the examined. We noticed a reliable reduction of FT3, T3, FT4 and T4 blood content by 2.25; 2.27; 2.45 and 2.67 times respectively (in all cases ($P < 0.001$) in the group with insufficient thyroid function as compared to such indices in the group with normal function. At the same time, the blood content of TSH was reliably 4.96 times higher ($P < 0.001$) than that of women with normal thyroid function. We also observed a 9.28-fold increase ($P < 0.001$) in the level of antibodies to thyroid peroxidase in all women with hypothyroidism as compared to women with euthyroidism. This indicates that the cause of hypothyroidism in all women was chronic autoimmune Hashimoto's thyroiditis. All women in this group complained about increasing body weight, so they all kept a hypocaloric diet for weight loss.

Women with hypothyroidism significantly limited the total amount of products consumed with food, eating proteins 1.47 times ($P < 0.001$), fats 2.21 times ($P < 0.001$) and carbohydrates 2.14 times ($P < 0.001$) less than women with normal thyroid function. The amount of table salt in their diet was 2.98 times less ($P < 0.001$) than that of women with normal thyroid function. Both the total amount of iodine consumed with food and the amount of iodine consumed with food salt were authentically ($P < 0.001$) 2.74 and 3.78 times less than in women with normal thyroid function. The average amount of products with the strumogen properties in the daily diet, which were mainly cabbage and soybeans, in women with hypothyroidism was 2.25 times higher ($P < 0.001$) than in women with normal thyroid function.

Discussion of the results. Analyzing the prevalence of thyroid function disorders in women under study, the data obtained should be compared with similar data from other studies [10]. Globally, about 200 million people suffer from thyroid dysfunction, which is estimated to be about 5% of the world's population [11]. Although, according to the GUS, 2014 data [2], 22% of the Polish population, or about 7 million people, suffer from thyroid dysfunction. The average prevalence of hypothyroidism is 2.0-2.5% [7, 10]. In our study, the percentage of women with hypothyroidism was 3.5%, which is consistent with Eastman C.J. data [12]. A slightly higher incidence of hypothyroidism in our study compared to the data described above can probably be explained by the fact that only women participated in the study. The latter are known to have a higher incidence of thyroid disease than men [13].

Despite the fact that hypothyroidism was a consequence of autoimmune thyroiditis, we observed in the examined women with hypothyroidism a disorders of iodine intake with foodin the form of its insufficient consumption. Although hypothyroidism was caused by Hashimoto's disease, insufficient accompanying iodine intake with food could potentiate the reduction of levels of thyroid hormones in blood. There are researches on the influence of iodine deficiency or excess in food on the possibility of hypo- or hyperthyroidism. Stolińska H., Wolańska D. [14], Jarosz M. [15] believe that iodine deficiency in food

The content of thyroid hormones in the blood and the amount of iodine consumed with food in women with hypothyroidism

	Euthyroidism, $n = 14$	Hypothyroidism, $n = 14$
TSH, mlU/l	1.62 ± 1.04	8.03 ± 0.65*
FT3, pg/ml	3.16 ± 0.42	1.40 ± 0.15*
FT4, ng/dl	1.30 ± 0.32	0.53 ± 0.05*
T3, ng/dl	105.21 ± 18.66	46.23 ± 4.54*
T4, ng/dl	7.38 ± 1.02	2.76 ± 0.30*
Antibodies to thyroid peroxidase, U/ml	5.22 ± 0.55	48.43 ± 0.48*
Body mass index	19.9 ± 1.4	22.1 ± 1.6
Total amount of iodine consumed per day with food, μg	453.7 ± 107.4	120.0 ± 12.3*
The amount of iodine consumed per day with food salt, μg	375.0 ± 25.6	136.8 ± 8.9*
The amount of salt consumed per day, g	12.5 ± 2.4	4.2 ± 0.8
The average amount of protein consumed per day, g	154.8 ± 17.7	105.6 ± 16.8*
The average amount of fat consumed per day, g	95.9 ± 10.5	43.2 ± 4,2*
The average amount of carbohydrates consumed per day, g	328.8 ± 23,6	150.9 ± 14.7*
The average amount of strumogens consumed per day, g	55.2 ± 6.3	124.4 ± 16.6*

Note: *significant difference in results compared with those in the group of women with normal thyroid function ($P < 0.001$)

leads to an increase in TSH levels and a decrease T3 and T4 levels in the blood. We have not seen any studies concerning the dietary preferences of patients with thyroid hypofunction. In our study, women with hypothyroidism received significantly fewer proteins, fats, carbohydrates and iodine with food than those with the normal gland function.

Hypothyroidism in the women examined was responsible for the increase in body weight. Therefore, all women with hypothyroidism were on a hypocaloric diet, which included less proteins and iodine than recommended for normal activities, and more strumogens. The diet used included a significant amount of cabbage as a low-calorie product, consisting mainly of fiber. However, the cabbage is a strumogen, a product that is an antagonist of thyroid hormones [16, 17]. Strumogens belong to a group of substances under the general name “goitrogens” - substances that are iodine antagonists, cause thyroid growth and prevent the synthesis of thyroid hormones.

The well-coordinated work of all body systems depends on the normal operation of the thyroid gland. An unbalanced diet with low protein content, high content of fast carbohydrates, alcohol, transfats can disrupt the work of the gland and lead to hypothyroidism and other disorders. An unbalanced diet in our patients in the form of protein and iodine deficiency, excessive intake of strumogens caused a decrease in the production of thyroid hormones and worsened hypothyroidism. There was a vicious circle where one cause of the pathogenesis led to the intensification of the other.

Conclusions. The prevalence of hypothyroidism among women aged 19-28 years in Biała Podlaskie County of Lubelskie Voivodeship in Poland constituted 3.5%, which is not significantly different from the values observed on average in the European Union. Examined women with hypothyroidism used an unbalanced hypocaloric diet that included reduced amounts of iodine and proteins as well as increased amounts of strumogens in order to reduce body weight. The use of such a diet could be the cause of a secondary decrease in thyroid function with further development of the clinical picture of hypothyroidism.

Conflict of interest. Authors have completed the Unified Conflicts of Interest form at http://ukrbiochemjournal.org/wp-content/uploads/2018/12/coi_disclosure.pdf and declare no conflict of interest.

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ДОСЛІДЖЕННЯ ОСОБЛИВОСТЕЙ ДІЄТИ ХВОРИХ НА ГІПОТИРЕОЗ

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Дослідження взаємозв'язку між харчовими особливостями та патогенезом гіпотиреозу є дуже актуальними. Мета цієї роботи – вивчити дієтичні особливості хворих на гіпотиреоз та визначити можливий вплив харчових уподобань пацієнтів на патогенез гіпотиреозу. Обстежено 400 жінок польської національності у віці 19-28 років, які проживають у районі Бяла-Підляски Люблінського воєводства Польщі і вважають себе здоровими. Визначали рівень вільного (FT3) і загального (T3) трийодтироніну, вільного (FT4) та загального (T4) тироксину, тиреотропного гормону (ТТГ), рівень антитіл до пероксидази щитоподібної залози. Кількісний та якісний склад раціону обстежуваних жінок визначали за допомогою анкет та таблиць харчової цінності продуктів. Виявлено, що поширеність гіпотиреозу серед обстежених жінок становила 3,5%. Показано, що жінки зі зниженою функцією щитоподібної залози споживали з їжою в 3,78 раза менше йоду, у 2,97 раза ($P < 0,001$) менше хлориду натрію (кухонної солі) і в 1,47 раза ($P < 0,001$) менше протеїнів ніж ті, хто мав функцію щитоподібної залози в нормі. Крім того, жінки з гіпотиреозом споживали в 2,25 раза ($P < 0,001$) більше продуктів зі стримогенними властивостями. Дійшли висновку, що застосування такої дієти може призвести до вторинного зниження функції щитоподібної залози з подальшим розвитком гіпотиреозу.

Ключові слова: гіпотиреоз, трийодтиронін, тироксин, гіпокалорійна дієта, йод.

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