



The effect of nutritional habits and addictions on the incidence of thyroid carcinoma in the Olsztyn province of Poland

Wpływ nawyków żywieniowych i używek na zapadalność na nowotwory złośliwe tarczycy w województwie olsztyńskim

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Abstract

Introduction: The aim of this study was to investigate the roles of nutritional habits and addictions in the incidence of thyroid carcinoma.

Material and methods: The study of risk factors affecting the incidence of thyroid carcinoma was conducted in patients included in a register of thyroid carcinoma. For that purpose, a questionnaire was prepared. The questionnaire covered: personal information, medical history, individual risk factors of thyroid carcinoma such as nutritional habits, alcohol consumption and smoking. Statistical analysis was conducted.

Results: The register comprised 297 patients with thyroid carcinoma (89% women) and 589 healthy subjects. 46% of patients declared frequent consumption of milk and dairy products. The patients with thyroid carcinoma consumed cruciferous plants significantly more often than healthy subjects ($p = 0.0001$) whereas egg consumption among both groups of patients was similar. Low consumption of fish and average table salt consumption was typical of both groups. Alcohol consumption was similar in both groups and was, respectively, 42.18% and 47.59%. The patients with thyroid cancer smoked less frequently than subjects from the control group. Logistic regression analysis showed that carcinoma risk increased in patients who consumed cruciferous vegetables (brassicas). Their regular intake was related to a 1.5-fold (CI 1.19–1.96) higher risk of thyroid carcinoma incidence. Despite the demonstrated decreased risk of thyroid cancer, smoking (OR 0.54) was not considered a protective factor.

Conclusions:

1. It is not possible to determine unequivocally the causative factors for the growth in the incidence of thyroid cancer in Olsztyn province.
2. It appears that one of the environmental factors causing the increase is overconsumption of cruciferous vegetables.

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Key words: thyroid carcinoma, environmental risk factors, nutritional habits, addictions.

Streszczenie

Wstęp: Celem pracy było zbadanie wpływu nawyków żywieniowych i używek na zapadalność na raka tarczycy.

Materiał i metody: Badanie przeprowadzono wśród chorych objętych rejestrem raka tarczycy. W przygotowanej ankiecie zawarto dane osobowe, wywiady i osobnicze czynniki ryzyka: nawyki żywieniowe, spożycie alkoholu i palenie papierosów. Uzyskane dane poddano analizie statystycznej.

Wyniki: Badaniem objęto 297 chorych na raka tarczycy (89% kobiet) i 589 zdrowych ochotników. Czterdzieści sześć procent badanych często spożywało mleko i jego przetwory. Pacjenci chorzy na raka tarczycy istotnie częściej niż grupa kontrolna spożywali warzywa krzyżowe ($p = 0,0001$), spożycie jaj było podobne w obu grupach. Niskie spożycie ryb oraz średnie spożycie soli i podobne spożycie alkoholu charakteryzowało obie grupy. Chorzy na raka tarczycy rzadziej palili papierosy. Na podstawie modelu regresji logistycznej wykazano, że częste spożywanie warzyw krzyżowych 1,5-krotnie zwiększało ryzyko wystąpienia nowotworu złośliwego tarczycy (95% CI 1,19–1,96) w stosunku do osób spożywających te warzywa niezbyt często. Osoby niepalące w stosunku do palących miały 0,54-krotne większe ryzyko zachorowania na nowotwory złośliwe tarczycy.

Wnioski:

1. Nie można jednoznacznie określić czynników sprawczych wzrostu zapadalności na raka tarczycy w województwie olsztyńskim.
2. Wydaje się, że jednym z czynników środowiskowych mających wpływ na wzrost zapadalności na raka tarczycy w tym regionie są nawyki żywieniowe w postaci nadmiernego spożycia warzyw krzyżowych. (Endokrynol Pol 2011; 62 (2): 145–150)

Słowa kluczowe: rak tarczycy, środowiskowe czynniki ryzyka: nawyki żywieniowe i używki

Wpływ modeli żywienia kobiet z przebytą cukrzycą ciężową na rozwój zespołu metabolicznego u kobiet oraz nadwagi i otyłości u potomstwa — grant Ministerstwa Nauki i Szkolnictwa Wyższego, zakwalifikowany do finansowania w 38. konkursie Program badań przesiewowych w kierunku retinopatii cukrzycowej w województwie warmińsko-mazurskim — projekt współfinansowany przez firmy Novo Nordisk Pharma Sp. z o. o. i Roche Diagnostics Polska Sp. z o. o.



Introduction

Recent years have seen an increasing trend in the incidence of cancer worldwide [1–3], including thyroid carcinoma [4, 5]. Many authors have attempted to answer the question whether nutritional habits and addictions could affect the growth of carcinoma of this organ [6–8]. Our study looks at the problem in Olsztyn province in the north-east of Poland, which was in the past an area of moderate iodine deficiency, and was significantly exposed to radiation after the Chernobyl accident in 1986.

The aim of the study was the investigation of nutritional habits and addictions in thyroid carcinoma incidence.

Material and methods

The prospective study on thyroid cancer was conducted in Olsztyn province between 1 January 1994 and 31 December 2003 within its former boundaries, disregarding the revised administrative division of Poland from January 1999. In the years 1999–2002, the register of thyroid carcinoma in Olsztyn province (now part of Warmia and Mazury provinces) was conducted within the National Programme for Elimination of Iodine Deficiency [9]. Olsztyn province is in the north-east of Poland, with an area of 12,327 km² (3.9% of the whole area of Poland). In 1994, its population was 769,200 and in 2002 it was 760,737, which made up 2% of the whole Polish population. In 1994, 60% of Olsztyn's population lived in 22 towns [10–12].

The register of thyroid carcinoma included patients meeting the following criteria:

- disease onset between 1 January 1994 and 31 December 2003;
- permanent residents of Olsztyn province, with respect to all age groups;
- thyroid carcinoma diagnosed on post-operational histopathological thyroid examination classified as ICD-9, ICD-10 in Department of Pathomorphology of District Specialist Hospital in Olsztyn and verified in Department of Pathomorphology of Medical Academy in Warsaw (or Oncology Centre of Institute in Gliwice from 1997) [13, 14].

The study looked at factors affecting the incidence of thyroid carcinoma among patients included in a standardised register. For that purpose, a questionnaire was prepared. Patients completed the questionnaire in person during medical checkups at the outpatient clinic. In cases of serious disability or change of address the answers were obtained by telephone or post (Table I).

The questionnaire covered: personal information, medical history (including the date of thyroid carcinoma diagnosis, method of diagnosing and treatment in-

Table I. Characteristics of patients with thyroid cancer who responded

Tabela I. Charakterystyka badanej grupy chorych na raka tarczycy objętych badaniami ankietowymi

Characteristics of patients with thyroid cancer	n (%)
Number of patients with thyroid cancer registered	462 (100.00)
Number of patients with thyroid cancer who died	77 (16.66)
Patients responded	
Personally	139 (30.08)
By post	151 (32.68)
By phone	4 (0.86)
Via members of family	3 (0.64)
Total	297 (64.28)

cluding operational treatment and complementary pharmacological treatment; occurrence of thyroid cancer in the course of other forms of endocrinopathy; body parameters: height [cm], mass [kg], body mass index (BMI) expressed as body height to mass ratio [kg/m²] assuming normal BMI between 18.5 kg/m² and 25 kg/m² [15], as well as data about individual risk factors of thyroid carcinoma such as nutritional habits, with the following groups of commonly consumed products: dairy products (milk, soft cheese, hard cheese, buttermilk), chicken eggs (consumed individually or in the form of pasta, cakes, or as additions to meat), cruciferous vegetables (cabbage, Brussels sprouts, cauliflower, broccoli, radish, turnip, swede, kale, horseradish) fish, either fresh-water or sea, and table salt.

The consumption of particular food products was assessed according to a three-point scale:

- frequent: 5–7 times a week or more
- average: 3–4 times a week
- infrequent: 0–2 times a week.

Table salt consumption was assessed as low (2–3 g), average (3–5 g), or high (over 6 g). In addition, the study covered alcohol consumption (12–24 g pure alcohol, which corresponds to 1–2 drinks; 300 ml of wine or 500 ml of beer) and smoking.

The control group consisted of 589 healthy subjects selected based on age and place of residence who, having given consent to take part in the study, completed the questionnaire for patients with thyroid carcinoma except for the questions concerning the principal disease. The characteristics of the control group are set out in Table II. The data obtained from the prepared questionnaire in the group of patients with thyroid carcinoma and the control group of healthy patients was anonymously entered into a computer database. Statistical

Table II. Characteristics of members of control group who responded**Tabela II. Charakterystyka osób z grupy kontrolnej objętych badaniami ankietowymi**

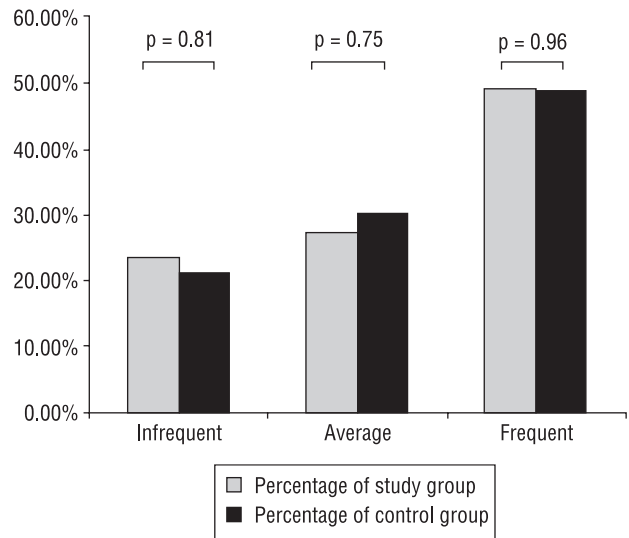
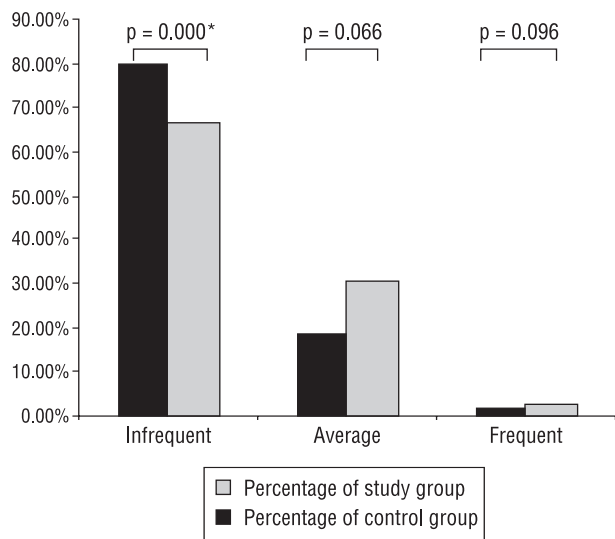
Age (years)	Control group n = 589		
	Sex	n (%)	Average age (years) ± SD
0–18	Girls	7 (58.33)	16.71 ± 1.38
	Boys	5 (41.67)	13.80 ± 2.17
> 18	Women	507 (87.87)	50.92 ± 13.01
	Men	70 (12.13)	46.33 ± 13.71
0–85+	Women	514 (87.27)	50.46 ± 13.52
	Men	75 (12.73)	44.16 ± 15.56
Total		589 (100.00)	49.66 ± 13.46

analysis was done using Statistica 7PL software. Logistic analysis determining the quotient for unitary change odds ratio was applied to analyse the effect of risk factors on developing cancer at a confidence limit of 95% CI. The hypotheses about a relation or lack of relation between variables in the nominal or ordinal scale were verified using Pearson test and Highest Credibility test. Poisson distribution was used for analysis of disease incidence. Two incidence rates of thyroid carcinoma were compared using normal approximation of Poisson distribution with test Z. Incidence trends were evaluated using linear regression analysis at 95% confidence limit (95% CI) and $p < 0.05$ [16–18].

Results

Between 1994 and 2003, 297 patients completed the 'Questionnaire for patients with thyroid carcinoma', as did 589 healthy subjects from the control group.

On analysing the collected data concerning the nutritional habits of the study subjects, it was observed that 46% of patients with thyroid cancer, as well as those from the control group, declared frequent consumption of milk and dairy products. Similar data was recorded for groups consuming these products with average and low frequency. No statistically significant differences were observed (Fig. 1). Figure 2 shows that patients with thyroid carcinoma consumed cruciferous plants significantly more often than healthy subjects ($p = 0.0001$), whereas Figure 3 shows that egg consumption among patients with thyroid carcinoma and healthy subjects was similar. No statistically significant differences were observed between the groups. Low consumption of fish was typical of both patients with thyroid cancer and subjects from the control group (94.35% *v.* 97.60%, respectively) as presented in Figure 4. Average table salt consumption was typical of

**Figure 1. Consumption of milk and dairy products — study group vs. control group****Rycina 1. Częstość spożycia mleka i jego przetworów w badanej grupie chorych na raka tarczycy i w grupie kontrolnej****Figure 2. Consumption of cruciferous vegetables – study group vs. control group****Rycina 2. Częstość spożycia warzyw krzyżowych w badanej grupie chorych na raka tarczycy i w grupie kontrolnej**

both patients with thyroid cancer and subjects from the control group (37% *v.* 35%) (Fig. 5).

The collected data concerning addictions is presented in Figures 6 and 7. From Figure 6, it follows that alcohol consumption was similar in both study and control groups and was, respectively, 42.18% and 47.59%, with no statistically significant differences.

Figure 7 demonstrates that patients with thyroid cancer smoked cigarettes less frequently than subjects

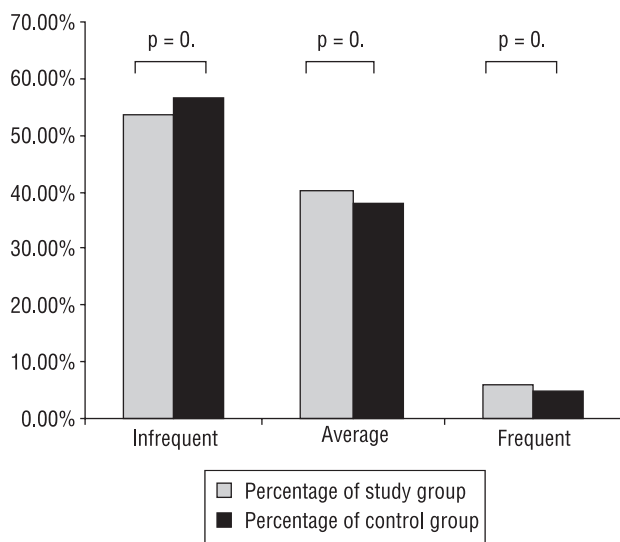


Figure 3. Consumption of eggs — study group vs. control group

Rycina 3. Częstość spożycia jaj kurzych w badanej grupie chorych na raka tarczycy i w grupie kontrolnej

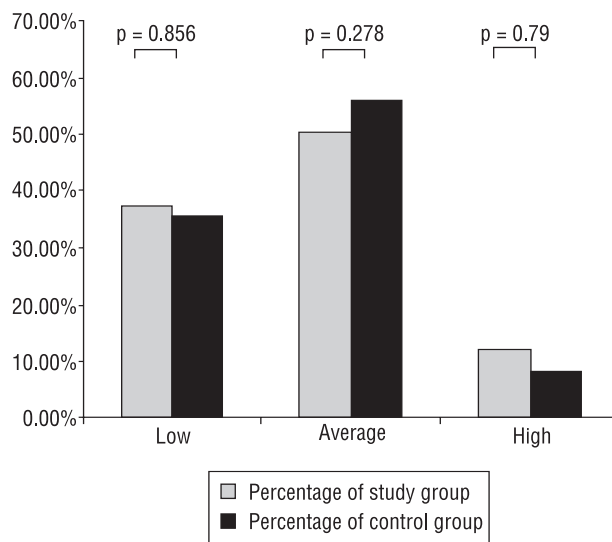


Figure 5. Salt intake — study group vs. control group

Rycina 5. Spożycie soli w badanej grupie chorych na raka tarczycy i w grupie kontrolnej

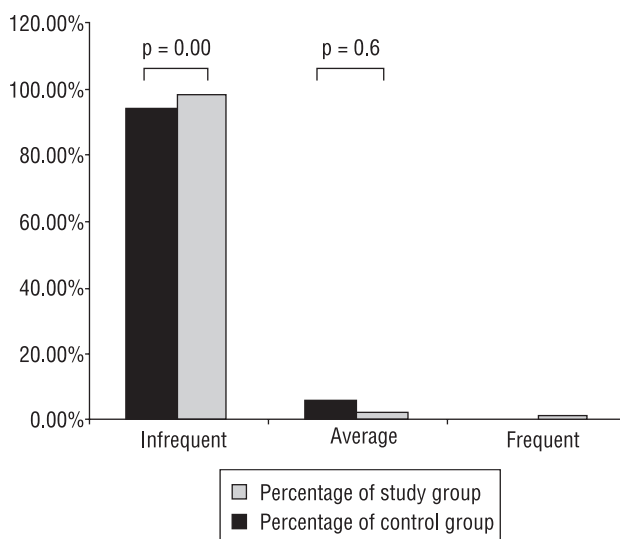


Figure 4. Consumption of fish — study group vs. control group

Rycina 4. Częstość spożycia ryb w badanej grupie chorych na raka tarczycy i w grupie kontrolnej

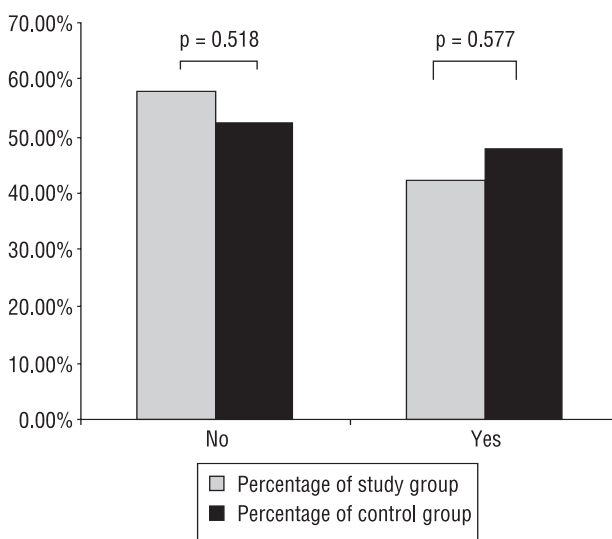


Figure 6. Consumption of alcohol — study group vs. control group

Rycina 6. Konsumpcja alkoholu w badanej grupie chorych na raka tarczycy i w grupie kontrolnej

in the control group (29.93% v. 43.10%, respectively, at $p = 0.003$). Logistic regression analysis showed that carcinoma risk increased in those patients who consumed cruciferous vegetables. Their regular intake was related to a 1.5-fold (CI 1.19–1.96) higher risk of thyroid carcinoma incidence. Despite the demonstrated decreased risk of thyroid cancer in smokers (OR 0.54, CI 0.39–0.73), it was not considered a protective factor (Table III).

Discussion

Nutritional habits

Consumption of milk and dairy products

The collected data shows that milk consumption was high, i.e. 5-7 times a week, both among patients with thyroid cancer and among subjects from the control group, similarly to that of eggs. This seems to indicate

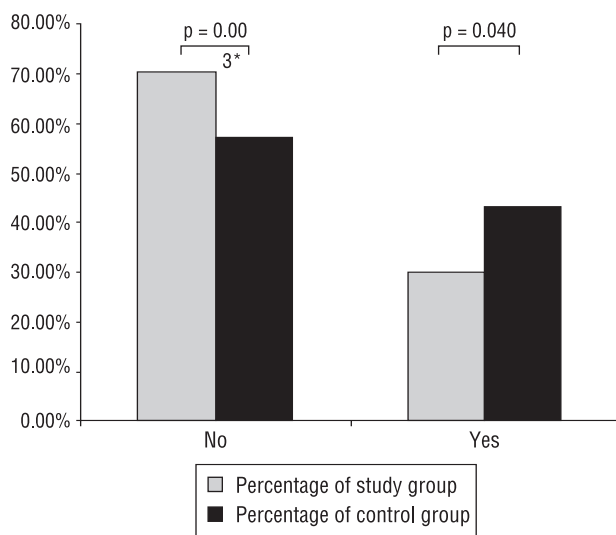


Figure 7. Cigarette smoking — study group vs. control group

Rycina 7. Palenie papierosów w badanej grupie chorych na raka tarczycy i w grupie kontrolnej

Table III. Thyroid carcinoma risk factors in study group with changes in odds ratio (OR)

Tabela III. Czynniki ryzyka zachorowania na raka tarczycy w badanej grupie chorych z określeniem ilorazu szans (OR) dla zmiany jednostkowej

Risk factors	OR (95% CI)	p
Age at onset of thyroid cancer	0.98 (0.97–0.99)	0.03
Body mass	0.98 (0.96–0.99)	0.00
Consumption of cruciferous vegetables	1.53 (1.19–1.96)	0.00
Cigarette smoking	0.54 (0.39–0.73)	0.00

that nutritional deficiency in dairy products and eggs was not a risk factor for thyroid carcinoma. No data is yet available on the relation between the intake of these products by the Polish population and increased risk of developing thyroid carcinoma. In the studies by Galanti and Franceschi, high consumption of dairy products was related to a higher incidence of thyroid cancer, whereas Mack did not observe any such relation [8, 19, 20]. Within their iodine prophylaxis model, the Polish Commission for Control of Iodine Deficiency Related Disorders recommends consumption of milk and dairy products and eggs as providing valuable sources of iodine [21]. From the available world and European data, it follows that consumption of products rich in iodine is a protective factor against the development of nodular goitre. That is why, apart from iodisation of table salt, this element is added also to cattle fodder and to bread [21].

Consumption of cruciferous vegetables

Excessive intake of cruciferous vegetables (also known as brassicas) has long been considered to be a risk factor for developing nodular goitre [22]. Since cabbage is one of the most frequently consumed vegetables in Poland, our study analysed also the effect of cruciferous vegetables on the incidence of thyroid carcinoma. Logistic regression analysis showed that consumption of cruciferous vegetables was related to a greater risk of developing thyroid cancer. Individuals frequently taking cruciferous vegetables had a 1.53-fold higher risk of developing thyroid cancer compared to those whose consumption was on average level, and who, in turn, had a 1.53-fold higher risk factor than those who consumed cruciferous vegetables rarely (95% CI, 1.19–1.96). The results of studies conducted in different countries have varied considerably. Some authors have confirmed our findings [20, 23], whereas other studies conducted in Sweden and the USA demonstrated that frequent consumption of cruciferous vegetables decreased the risk of thyroid cancer [20, 24, 25]. Italian, Greek and other Swedish authors also did not observe such a relation [6].

Fish consumption

The relation between consumption of fish and development of thyroid cancer has been pointed out by American authors [24], according to whom frequent consumption of fish (three or more times a week) caused an increase in thyroid cancer incidence. In contrast, authors from northern Europe have reported no significant relations between fish consumption and increased risk of thyroid cancer [7, 20]. From the data provided by the National Institute of Food and Nutrition, fish consumption in Poland is very low compared to highly developed countries [26]. Our studies show that fish consumption both in the patients with cancer, and in the control group, was even lower than in other regions of Poland. Hence, the question concerning a relation between fish consumption and risk of developing thyroid cancer in our region and in the whole of Poland remains unanswered.

Table salt consumption

Thirty seven per cent of patients with thyroid carcinoma and 35% of those from the control group estimated their table salt consumption was average, i.e. 3–5 g/day. The others estimated it was low or high. Such results did not coincide with the results obtained by the Institute of Food and Nutrition in the year 2000, according to which the Polish population takes sodium chloride

in an amount exceeding the daily WHO recommended dose, i.e. 5.0–6.0 g [27].

At present, thanks to obligatory table salt iodisation and high salt consumption, no iodine deficiency can be observed. It should be stressed that the recommendations by the Polish Commission for Control of Iodine Deficiency Related Disorders are contradictory to prophylaxis educational programmes aimed at limiting salt consumption within preventing such diseases as atherosclerosis or hypertension. Therefore, we should aim at obligatory iodisation of cattle fodder and enriching cow's milk with iodine as they may be an important iodine carrier, especially for pregnant women and young children [21].

Addictions

According to the study by Mack et al., which was a meta-analysis of the effect of addictions (alcohol, cigarettes) on the development of thyroid cancer, a lower carcinoma risk was observed in women who drank alcohol, and the risk was lower in currently drinking women [8, 28]. They did not show a significant relation between alcohol consumption and the risk of developing thyroid cancer. The results of studies on the effect of smoking were more interesting. In our study, logistic regression analysis showed that individuals who smoked had a 0.54-fold lower risk of developing thyroid cancer than those not smoking (95% CI 0.39–0.73). Different conclusions were presented by Przybylik-Mazurek et al. who showed that smoking was related to an increased risk of developing thyroid carcinoma [29]. In turn, worldwide reports provide contradictory data. Rossing et al. observed a reduced risk of developing thyroid cancer among smokers [28] whereas Ron et al. did not find such a relation [24]. To sum up, even though in our observations smoking cigarettes was related to a reduced risk of developing thyroid cancer, it is difficult to accept not smoking as a risk factor for thyroid cancer, especially given that the addiction is a well-known risk factor for thyroid and lung cancer [30, 31].

Conclusions

1. It is not possible to determine unequivocally the causative factors for the growth in the incidence of thyroid cancer in Olsztyn province.
2. It appears that one of the environmental factors causing the increase is overconsumption of cruciferous vegetables.

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