Dietary patterns as risk factors of differentiated thyroid carcinoma

Sposób odżywiania jako czynnik ryzyka zróżnicowanego raka tarczycy

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Summary

Nutritional factors are known to be important in the development of different metabolic diseases. The history of nodular or diffuse goiter is closely related to risk of thyroid carcinoma. On account of the function of the thyroid gland, many studies focus on iodine intake.

The aim of the study was to assess whether dietary patterns could be risk factors of differentiated thyroid carcinoma.

Material/Methods:

The case-control study was based on a questionnaire, which included information about dietary patterns and was carried out on 284 patients comprising 30 males (mean age 58.4±13.7 years), and 254 females (mean age 52.1±13.8 years), as well as 345 randomly selected controls: 58 males (mean age 60.2±12 years) and 287 females (mean age 53.4±14.3 years) randomly selected from the Population Register and adjusted by age and gender to the group of TC. The main groups of nutritional products, i.e. starchy foods, meat, dairy products, vegetables, fruits, and beverages, were analyzed.

Results:

Consumption of vegetables, fruits, saltwater fish and cottage cheese was significantly lower in patients with differentiated thyroid carcinoma than in controls, quite the contrary to starchy foods, especially white bread.

Conclusions:

Dietary patterns appear to modify the risk of thyroid carcinoma. A diet rich in vegetables and fruit, as well as saltwater fish (a source of iodine) and low-fat meat, could be an important protective factor.

Key words: thyroid carcinoma • dietary pattern • risk factors • vegetable • coffee

Streszczenie

Czynniki żywieniowe odgrywają ważną rolę w rozwoju różnych chorób metabolicznych. Wywiad w kierunku wola guzkowego lub wola miąższowego jest ściśle związany ze zwiększonym ryzykiem rozwoju zróżnicowanego raka tarczycy (ZRT). Wielu autorów koncentruje swoją uwagę na roli spożycia jodu w funkcjonowaniu tarczycy i miejscu niedoboru tego pierwiastka w patogenezie chorób tarczycy.

Celem badania była ocena czy sposób odżywiania może wpływać na zwiększenie ryzyka ZRT.
INTRODUCTION

Nutritional factors are known to be important in the development of different metabolic diseases. The history of nodular or diffuse goiter is closely related to the risk of thyroid carcinoma (TC). Therefore, researchers of thyroid gland function focus on iodine intake. In Europe a high incidence of thyroid carcinoma is described in iodine deficient areas [8,16]. Moreover, introduction of iodine prophylaxis shifts the incidence toward the less aggressive papillary type [18,23]. However, dietary factors other than iodine deficiency play a role in the genesis of endemic goiter [7,15]. Some population-based studies have shown that the relation between iodine intake and thyroid function is not linear, and both iodine deficiency and iodine excess may interfere with the synthesis of thyroid hormones and cause goiter [5].

Aim of the study

The aim of the study was to assess whether dietary patterns could be a risk factor of differentiated thyroid carcinoma (DTC).

MATERIALS AND METHODS

The case-control study was based on a questionnaire, which included information about dietary patterns with the following groups of commonly consumed products: starchy foods, vegetables and fruits, dairy products, meat, fish, fats and beverages. It was carried out on 284 patients diagnosed as having TC, and 345 controls in 1996–1998. All of them were inhabitants of a southern Poland district defined as an iodine-deficient area. Fifty questions about food aimed to obtain an average frequency of consumption, given standard portion sizes. The time to which the dietary habits were referred was ten years before diagnosis of DTC and in controls ten years before questionnaire completion.

Patients: 30 males (mean age 58.4±13.7 years), and 254 females (mean age 52.1±13.8 years). Cases were included in the Regional Register of Thyroid Cancer after pathological diagnosis of DTC.

Controls: 58 males (mean age 60.2±12 years) and 287 females (mean age 53.4±14.3 years) randomly selected from the Population Register and adjusted by age and gender to the group of TC.

The main groups of nutritional products were analyzed: starchy foods, meat, dairy products, vegetables, fruit, and beverages.

The frequency of food and beverage consumption was analyzed as an estimated number of portions per month. Statistical analysis was conducted using the statistical package Statistica 8.0 PL.

ANOVA was applied and Student’s t-test was used to determine significant differences between group means, where p<0.05 was considered significant.

RESULTS

There was a higher, but not statistically significant consumption of fiber-rich starchy foods in the control group, i.e. wholegrain bread, grits, and composed with other nutritional products such as dumplings and pasta. In contrast, white bread and rice were more often present in the diet of DTC patients (Table 1).

All groups of vegetables and some groups of fruits were more often consumed by healthy people. Statistical significance was reached for vegetable products rich in antioxidants, vitamins and fiber (Table 2).
There was a higher consumption of poultry, ham, fish, cheese, cottage cheese and margarine in the control group. Animal products rich in saturated fatty acids such as pork and cream were more often components of DTC patients’ diets (Table 3).

The consumption of juices, coffee and chocolate was higher in the control group. Differences for coffee met statistical significance (Table 4).

**Discussion**

Our study suggests that some dietary patterns are associated with the risk of differentiated DTC. High intake of fatty (pork, cream) and starchy foods (especially refined wheat and rice) was observed in patients more frequently than in controls. Consumption of ham and poultry, and fish (i.e. low fat products) was more often observed in healthy people. We have shown an adverse relationship between DTC prevalence and consumption of iodine-rich foods such as saltwater fish and fish products. These data are similar to previous studies [10,11,12,26]. A diet rich in vegetables seems to play a protective role, which is in agreement with other authors’ studies. Vegetables may affect the risk of thyroid cancer probably via several pathways: goitrogenic and anticarcinogenic effects of thiocyanates contained in cruciferous vegetables, or via antioxidative vitamins C and E and beta-carotene in these products [2,3,7]. The latter can explain the protective, anticarcinogenic role of fruit, especially rich in vitamin C citrus fruits. Cabbage is one of the most frequently consumed vegetables in Poland. Excessive intake of cruciferous vegetables has long been considered to be a risk factor for developing nodular goiter [9]. Some authors have demonstrated that consumption of cruciferous vegetables was related to a greater risk of developing TC, especially in a group of patients with mild iodine deficiency [1,20,24]. Our data

**Table 1. Consumption of starchy foods in patients and controls**

| Product  | DTC patients portion ±SD | Controls portion ±SD | p    |
|----------|--------------------------|----------------------|------|
| White bread | 30.47±18.33              | 27.93±16.09          | 0.0561|
| Wholegrain bread | 32.50±43.26             | 34.67±34.67          | 0.4245|
| Grits    | 5.11±6.44                | 5.63±6.20            | 0.1882|
| White rice | 6.16±7.98                | 5.96±4.66            | 0.3767|
| Dumplings | 3.59±4.47                | 4.11±8.47            | 0.2140|
| Pasta    | 7.26±5.79                | 8.63±10.13           | 0.0448|

**Table 2. Consumption of vegetables and fruits in patients and controls**

| Product  | DTC patients portion ±SD | Controls portion ±SD | p    |
|----------|--------------------------|----------------------|------|
| Tomato   | 14.09±12.89              | 14.14±15.35          | 0.4866|
| Lettuce  | 1.14±2.94                | 2.27±5.20            | 0.0030|
| Cabbage  | 5.60±4.77                | 6.67±7.06            | 0.0333|
| Cauliflower | 0.68±1.05               | 1.16±2.48            | 0.0056|
| Green pea | 0.81±1.52                | 1.24±2.50            | 0.0151|
| Bean     | 2.36±1.95                | 3.33±5.64            | 0.1353|
| Radish   | 0.50±1.30                | 1.15±3.14            | 0.0031|
| Carrot   | 5.10±4.90                | 5.85±5.26            | 0.0563|
| Beetroot | 4.10±3.59                | 5.17±5.03            | 0.0082|
| Potato   | 32.22±32.73              | 32.44±33.94          | 0.4729|
| Vegetable soup | 4.96±4.18               | 6.64±9.73            | 0.0116|
| Citrus fruit | 7.46±11.31              | 11.30±14.21          | 0.0009|
| Apple    | 33.58±34.87              | 38.01±63.70          | 0.3861|
| Pear     | 0.34±1.05                | 0.94±3.10            | 0.0044|
| Plum     | 1.48±6.68                | 1.24±3.14            | 0.3479|
suggest that lettuce, cabbage, cauliflower, radish as well as green pea and beetroot containing beta carotene can play a protective role. Similar findings have been made by other researchers, who have proved a decreased risk of TC for the highest level of cruciferous vegetable intake [4,12,14,22].

We were unable to show an association of egg and milk consumption with DTC. This seems to indicate that nutritional deficiency in dairy products and eggs was not a risk factor for TC [1,19]. Regardless of the above, we have revealed that consumption of cottage cheese was significantly higher in healthy subjects.

An interesting finding is that patients with DTC drank less coffee than healthy controls. A similar observation has been obtained by other authors, who have shown that

| Product            | DTC patients portion ±SD | Controls portion ±SD | P     |
|--------------------|--------------------------|----------------------|-------|
| Veal               | 1.60±3.31                | 1.65±2.94            | 0.4282|
| Poultry            | 6.65±4.48                | 7.50±5.88            | 0.0481|
| Giblets            | 1.38±3.45                | 1.64±2.51            | 0.1734|
| Ham                | 13.22±12.47              | 18.10±14.35          | 0.0001|
| Sausage            | 10.75±12.49              | 12.40±14.87          | 0.1037|
| Pork               | 3.98±4.93                | 3.62±4.44            | 0.2048|
| Saltwater fish     | 3.09±2.38                | 3.59±3.11            | 0.0065|
| Freshwater fish    | 0.59±3.14                | 0.47±1.56            | 0.0303|
| Tinned fish        | 1.57±1.85                | 1.95±2.78            | 0.0502|
| Milk               | 22.93±25.77              | 22.43±24.01          | 0.4146|
| Yoghurt            | 8.77±11.25               | 8.54±12.83           | 0.4198|
| Buttermilk/kefir   | 5.81±7.57                | 8.35±24.56           | 0.0806|
| Cheese             | 12.97±12.82              | 13.25±18.45          | 0.4272|
| Cottage cheese     | 15.56±12.44              | 20.57±22.30          | 0.0023|
| Cream              | 14.45±18.21              | 13.03±12.06          | 0.1555|
| Eggs               | 10.46±10.75              | 10.38±9.94           | 0.4661|
| Butter             | 23.36±20.36              | 23.77±24.28          | 0.4397|
| Margarine          | 7.63±12.20               | 12.20±14.13          | 0.0348|

| Product            | DTC patients portion ±SD | Controls portion ±SD | P     |
|--------------------|--------------------------|----------------------|-------|
| Water              | 4.11±18.79               | 3.75±16.61           | 0.4612|
| Mineral water      | 23.32±28.79              | 19.89±26.10          | 0.0894|
| Juices             | 10.21±11.19              | 11.29±13.04          | 0.1728|
| Tea                | 86.71±70.53              | 85.91±66.18          | 0.4501|
| Coffee             | 17.78±13.63              | 22.56±11.64          | 0.0353|
| Chocolate          | 2.33±4.67                | 2.63±4.27            | 0.3087|
| Beer               | 0.37±2.33                | 0.51±2.13            | 0.2499|
| Wine               | 0.36±2.36                | 0.14±0.35            | 0.2620|
| Alcohol            | 0.06±0.29                | 0.07±0.25            | 0.4084|

Table 3. Consumption of meat, fish, dairy products and fats (vegetable and animal) in patients and controls

Table 4. Consumption of beverages in patients and controls
drinking coffee could decrease the risk of certain carcinomas [17,21,25]. Cardenas et al. suggested that a coffee diterpene might have a protective role and therefore act as the anti-angiogenic factor of coffee [6].

It is possible that the overall impact of particular dietary components on thyroid gland carcinogenesis depends not only on iodine intake but on their interaction with other dietary components. Description of new functions of nutritional factors depending on environmental factors, climate, UV, and pollution probably could explain their role in carcinogenesis. However, no one questions the importance of other, personal factors related to physiological aspects and the patient’s lifestyle.

**Conclusions**

Dietary patterns appear to modify the risk of DTC. A diet rich in vegetables and fruit, as well as saltwater fish (a source of iodine) and low-fat meat, could be important protective factors.

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