ACTA ONCOLOGICA

Vol. 31
No. 4

1992

# BREAST CANCER AND SMOKING, VODKA DRINKING AND DIETARY HABITS

## A case–control study

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**The relationship between cigarette smoking, vodka drinking and consumption of 44 food items typical of the Polish diet were analysed in a case–control study in Cracow, Poland, among 127 cases of breast cancer and 250 controls randomly selected from the general population. Cigarette smoking was not significantly influencing the breast cancer risk. Compared with never-drinkers, the habit of vodka drinking 20 years earlier significantly increased breast cancer risk in women below 50 years of age (multivariate OR was 4.4 with 95% CI 1.6–12.4). Frequent consumption of boiled vegetables 20 years earlier ( >3 times per week) was associated with a decreased risk of breast cancer in women aged 50 years and more (multivariate OR was 0.4 with 95% CI 0.2–0.8).**

'Only little progress has been made recently in the understanding of risk factors in female breast cancer (1). Moreover, several factors shown to be associated with breast cancer risk cannot be easily modified (2). Attention has therefore been focused on some factors that may be more amenable to change, such as smoking, alcohol and diet. So far, however, there is no consensus on the role of these factors for the breast cancer risk. Some circumstances may make Poland especially suitable for studies of the mentioned supposed risk factors in breast cancer:

- Poland had one of the greatest reported increases in the age-adjusted death rates for breast cancer from 1956–1957 to 1976–1977 (3),
- the Polish brands of cigarettes are known for their unusually high content of tar-like substances and nicotine, the habit of drinking strong alcohol (mainly vodka) is common, and great changes have taken place in the Polish diet in the post-war period, such as a marked increase in meat and drop in the consumption of cereals (4, 5).

Submitted 16 August 1991.
Accepted 30 November 1991.
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The present paper reports the results of a case–control study which included analyses of the role of cigarette smoking, vodka drinking and diet.

The cases were 127 women with histologically confirmed carcinoma of breast, obtained from the population-based Cracow Cancer Registry (75% of all invited women with histologically verified breast cancer, living in Cracow and diagnosed during a 12-month period in 1987, i.e. those who completed the questionnaire).

The controls were 250 age-matched women randomly selected from the general population in Cracow by using electoral roll and systematic sampling. Only women without a past history of breast cancer according to the cancer registry were selected as controls. Each case was matched by age (within 5 years) and place of residence (district of town) with 2 controls.

All cases and controls were asked to complete a mailed self-administered questionnaire with questions about sociodemographic factors, weight and height, history of smoking, habit, frequency and amount of beer consumption, wine and vodka in the past (about 20 years ago) and frequency of past (about 20 years ago) consumption of 44 food items typical for the Polish diet.

Concerning smoking the women were asked whether they had ever smoked daily as a regular habit and, if so, about the age at which they started smoking, total number of years of smoking, whether they currently smoked or

which year they stopped, their preferred type of tobacco (cigarettes, cigars, pipe) and the average amount smoked per day.

Questions on alcohol elicited information on whether the women ever drank beer, wine and vodka about 20 years ago and, if so, on how often they drank (daily, 3–4 times per week, 1–2 times per week, 1–2 times per month, less frequently) and the average amount in g.

The frequency of past consumption of the different food items (about 20 years ago) was quantified on a 5-grade scale: 1) daily; 2) 6–4 times per week; 3) 2–3 times per week; 4) once per week; 5) less frequently.

The average delay between diagnosis of cancer and inverview was 3 months and between notification at cancer registry and interview 1 month. The percentage of participation was 74.7 for cases and 73.5 for controls.

Before the final analysis, a subset of 15 cases (12% of total) and 26 controls (10% of total) proportionally allocated to 5-year groups, was requestioned six months after the initial interview. For these persons, the correspondence between the two responses was assessed using the overall percentage agreement, i.e. total percentage of observations for which there was agreement between the responses. Only factors for which the overall percentage agreement was at least 60% were approved as sufficiently reproducible for the present study (6).

Statistical analysis was made separately for women below 50 years of age (premenopausal) and 50 years of age or more (postmenopausal) at the time of diagnosis. The investigation was originally designed as a 1:2 matched case–control study. However, because of non-response only 127 cases and 250 controls were available. Unmatched analyses were, therefore, performed. Statistical analysis was made by maximum likelihood estimation of the parameters of a logistic regression model (7).

The odds ratios (OR), with their 95% confidence intervals, were calculated for smoking, past alcohol drinking and past consumption of certain food items. In addition to calculations of the age-adjusted odds ratios, unconditional multiple logistic regression was used to account simultaneously for the potential confounding effect of several factors. Then, the regression equations included terms for age, education (elementary, secondary or university) social class (manual, office or domestic), marital status (single or ever married), number of persons in household (1–2, 3–4, 5 or more), body mass index (BMI) = $kg/m^2$ (less than 27.0 and 27.0 or more). BMI = 27.0 $kg/m^2$ was used as cut-off point on the basis of a previous Polish study on breast cancer and body mass (8).

The analysis was restricted to sufficiently reproducible and complete data (with an overall percentage agreement >60% and completeness of data >90%). Cut-off points for dietary factors were selected on the basis of the average reported frequency of consumption.

For smoking data, additional adjustment was made for the past habit of vodka drinking, the data for vodka were adjusted for years of smoking, and the nutritional data for years of smoking and previous habit of vodka drinking. For factors significantly influencing the risk of breast cancer in two exposure categories, the significance of the linear trend was also tested (7).

**Table 1**

*Age distribution of 127 cases of breast cancer and 250 controls*

| Age (years) | Cases | | Controls | |
|---|---|---|---|---|
| | n | (%) | n | (%) |
| 35–39 | 8 | (6.3) | 17 | (6.8) |
| 40–44 | 11 | (8.7) | 20 | (8.0) |
| 45–49 | 14 | (11.0) | 24 | (9.6) |
| 50–54 | 20 | (15.7) | 40 | (16.0) |
| 55–59 | 15 | (11.8) | 34 | (13.6) |
| 60–64 | 16 | (12.6) | 36 | (14.4) |
| 65–69 | 18 | (14.2) | 28 | (11.2) |
| 70–74 | 11 | (8.7) | 24 | (9.6) |
| 75+ | 14 | (11.0) | 27 | (10.8) |
| Total | 127 | (100.0) | 250 | (100.0) |

## Results

There were 33 cases of female breast cancer below 50 years of age with 61 controls and 94 cases of breast cancer aged 50 years or more with 189 controls (Table 1). The cases were slightly more educated than controls and tended to be of higher social class, more often unmarried and with a smaller size of household. Mean BMI ± SD for cases and controls below 50 years of age was 21.5 $kg/m^2$ ± 1.3 and 21.2 $kg/m^2$ ± 1.8 respectively and for women aged 50 years and more 24.2 $kg/m^2$ ± 1.6 and 24.0 $kg/m^2$ ± 1.9.

Information about cigarette smoking and past alcohol intake was regarded as sufficiently reproducible for the analysis. However, data about past drinking of beer and wine were incomplete.

Cigarette smoking and duration of smoking were not significantly associated with the risk of breast cancer (Table 2).

The habit of vodka drinking about 20 years ago was significantly associated with an increased risk of breast cancer for women below 50 years of age (Table 3). Among 44 ever-drinkers of vodka in this age group 37, i.e. 84%, had drunk vodka in the past with a frequency less than once per month. Among the 37 ever-drinkers of vodka with this frequency the risk of breast cancer increased linearly with increasing amount of vodka per drink (with never-drinkers as reference category the multivariate OR for drinkers of less than 50 g of vodka per drink was 4.4 (1.1–18.0) and for drinkers of 50 g of vodka and more 6.3 (1.8–21.9), p-value for linear trend in OR = 0.0002). Data about past consumption of boiled vegetables, eggs,

**Table 2**

*Odds ratios (95% CI) for breast cancer according to smoking habits*

| | Number of | | Odds ratios (95% CI) | |
|---|---|---|---|---|
| | Cases | Controls | Age-adj. | MLR* |
| Below 50 years of age | | | | |
| Never-smokers | 20 | 31 | 1.00** | 1.00** |
| Ever-smokers | 13 | 30 | 0.7 (0.3–1.6) | 0.7 (0.3–1.7) |
| <20 yr | 8 | 19 | 0.7 (0.2–2.0) | 0.3 (0.1–1.2) |
| ⩾20 yr | 5 | 11 | 0.7 (0.2–2.3) | 0.5 (0.1–2.3) |
| Aged 50 years and more | | | | |
| Never-smokers | 65 | 145 (77) | 1.00** | 1.00** |
| Ever-smokers | 29 | 44 (23) | 1.5 (0.9–2.7) | 1.4 (0.8–2.6) |
| <20 yr | 9 | 13 (7) | 1.6 (0.6–4.2) | 1.52 (0.57–4.08) |
| ⩾20 yr | 20 | 31 (16) | 1.5 (0.8–2.8) | 1.5 (0.7–3.2) |

* Estimates from multiple logistic regression equations including terms for age, education, social class, marital status, number of persons in household, body mass index and drinking of vodka 20 years earlier.
** Reference category.

**Table 3**

*Odds ratios (95% CI) of breast cancer according to drinking of vodka 20 years earlier*

| | Number of | | Odds ratios (95% CI) | |
|---|---|---|---|---|
| | Cases | Controls | Age-adj. | MLR* |
| Below 50 years of age | | | | |
| Never-drinkers | 11 | 39 | 1.00** | 1.00** |
| Ever-drinkers | 22 | 22 | 3.8 (1.5–9.9) | 4.4 (1.6–12.4) |
| Aged 50 years and more | | | | |
| Never-drinkers | 34 | 78 | 1.00** | 1.00** |
| Ever-drinkers | 55 | 100 | 1.2 (0.9–2.7) | 1.2 (0.8–2.6) |
| ? | 5 | 11 | | |

* Estimates from multiple regression equations including terms for age, education, social class, marital status, No. of person on household, body mass index and 20 years previous habit of smoking (yr).
** Reference category.

sausages, bacon, pickled cucumbers and chocolate (i.e. about 13.6% of the examined products) by women below 50 years of age and about butter, fruits, eggs, fresh vegetables, carrots, margarine, lard and bacon by women aged 50 years and over (i.e. about 18.2% of the products included) were not accepted because of low reproductibility.

Information about past consumption of white bread, sugar, pork, jam, honey, compotes, cottage cheese, milk, cereals, fresh vegetables, rye bread, veal and sweets by women below 50 years of age, and of yellow cheese, sausage, vegetable oil, liver, pickled cucumbers and pepper by women aged 50 years and over (i.e. about 30% of the examined products for both groups of age) was lacking in more than 10% of the examined.

Products with accepted information about past frequency of consumption (including high-fat products — Table 4) were not significantly associated with the breast cancer risk for women below 50 years of age. Among

**Table 4**

*Odds ratios of breast cancer associated with high-fat products (fat content > 20%)*

| Product and frequency of consumption in the past | Odds ratios (95% CI) | | | |
|---|---|---|---|---|
| | Below 50 years of age | | Aged 50 years and more | |
| | Age-adjusted | MLR* | Age-adjusted | MLR* |
| Vegetable oil | ** | ** | ** | ** |
| Lard | ** | ** | ** | ** |
| Margarine | | | | |
| (⩾once per/week | 0.5 | 0.8 | ** | ** |
| v rare) | (0.2–1.3) | (0.3–2.7) | | |
| Butter | | | | |
| (each day (0.3–1.9) | 0.7 | 0.5 | ** | ** |
| v. rare) | | (0.1–2.0) | | |
| bacon | ** | ** | ** | ** |
| Liverwurst | | | | |
| (⩾once per/week | 0.8 | 0.5 | 0.9 | 0.9 |
| v. rare) | (0.3/1.8) | (0.1–1.6) | (0.5–1.5) | (0.5–1.5) |
| Pork | | | | |
| (>3 times per/week | ** | ** | ** | ** |
| v. rare) | | | | |
| Ham | | | | |
| (⩾once per/week | ** | ** | 1.1 | 1.1 |
| v. rare) | | | (0.6–1.7) | (0.6–1.9) |
| Fish in oil | | | | |
| -tinned | | | | |
| (⩾once per/week | 0.9 | 0.4 | 1.0 | 0.9 |
| v. rare) | (0.4–2.2) | (0.1–1.6) | (0.6–1.7) | (0.5–1.6) |
| Sausages | ** | ** | ** | ** |

* Estimates from multiple logistic regression equations including terms for age, education, social class, marital status, No of person in household, years of smoking, body mass index and drinking of vodka 20 years earlier.

** Information not accepted because of low reliability or incompleteness.

women aged 50 years and over, only one significant association was observed. There was a significant trend ($p = 0.01$) of decreasing risk with increasing past frequency of boiled vegetable consumption (Table 5).

## Discussion

In the present study, smoking was not significantly associated with the risk of breast cancer, which is in agreement with earlier findings in cohort studies and in a majority of case–control studies (9–22).

According to Longnecker et al. (23) the alcohol–breast cancer association seems to vary with national levels of alcohol consumption. Studies on a relationship between alcohol consumption and breast cancer have been reported from countries with an Anglo-Saxon type of drinking (i.e. drinking of diluted alcohol as a part of daily life), or Roman type of drinking (mainly wine) (24). To my knowledge, no studies have been reported from Slav countries, where the main type of alcohol is vodka. In the present study from Poland, questions about vodka drinking were strictly related to drinking 20 years earlier. The reporducibility of drinking data was checked by reinterviewing a subsample of about 10% of the persons.

Reproducibility may be regarded as an expression of reliability (25). The simplest and the most frequently used index of reproducibility is the overall proportion of agreement (6). The overall percentage agreement for the vodka data was at least 60% which was regarded as sufficient for the purpose of the present study. According to the Cracow data, vodka drinking 20 years earlier was significantly associated with increased breast cancer only in women below 50 years of age. These data support the hypothesis that it is mainly alcohol intake before the age of 30 that influences the breast cancer risk (26). A more pronounced effect of alcohol in women below 50 years of age has also been reported by other investigators (27–29). The alcohol intake in the Cracow study could not be accurately re-expressed in grams per day. However, the available data indicate that vodka drinking 20 years earlier with a frequency of less than once a month and in amounts of less than 50 g significantly elevated the risk of breast cancer for

**Table 5**

*Odds ratios of breast cancer associated with past frequency of boiled vegetables consumption. Women aged 50 years and more*

| Frequency of consumption in the past (times per week) | Number of | | Odds ratios | |
|---|---|---|---|---|
| | Cases | Controls | Age-adjusted | MLR* |
| ⩽1 | 23 | 26 | 1.00** | 1.00** |
| 2–3 | 20 | 38 | 0.6 (0.3–1.3) | 0.5 (0.3–1.2) |
| >3 | 42 | 112 | 0.4 (0.2–0.8) | 0.4 (0.2–0.8) |
| p-value for linear trend | | | 0.04 | 0.01 |

* Estimated from multiple logistic regression equation including terms for age, education, social class, marital status, No of person in household, years of smoking, body mass index and drinking of vodka 20 years earlier.
** Reference category.

women below 50 years of age. In this group the risk increased linearly with increasing amount of vodka per drink.

Potential, plausible mechanisms whereby such small amounts of alcohol might increase the risk of breast cancer have been suggested but not confirmed. Roslonowska et al. (30) have shown disturbances of neurohormonal function of the hypophysis after drinking 1 g of 100% alcohol per 1 kg body mass. On the other hand, it has been suggested that participants in epidemiological studies may underestimate their alcohol intake (31). Thus, the amounts of vodka associated with increased breast cancer risk could be larger than found in the Cracow study.

However, the risk found in this study is consistent with results of several epidemiological studies (24).

Several recent reports have reviewed the evidence that diet is involved in the etiology of breast cancer (32, 33). While the results of both animal and descriptive-ecological studies support positive association between dietary fat intake and breast cancer risk, evidence from analytic epidemiologic studies has been either weak or absent. Explanations of this controversy have focused on methodological issues, such as the narrow range of fat intake in the populations studied and problems related to measuring diet (34). A positive association between high fat intake and breast cancer risk seems to be restricted to postmenopausal women with a reported relative risk of about 1.5 (33). However, within a given population there are rather small differences in the fat intake, which reduces the likelihood of obtaining meaningful results from an epidemiological analysis (32).

A serious restriction on the conduct and interpretation of case–control studies on diet and cancer is the difficulty in obtaining reliable information about diet many years previously.

Informations on current diet is probably more reliable but may, on the other hand, be poorly correlated to past diet and therefore less relevant when studying associations between diet and cancer (35).

In the present study, the reproducibility and completeness of nutritional data were assessed, a practice that is commonly overlooked (25). If the overall percentage of agreement among two responses about past consumption was at least 60% and completeness of information was at least 90%, the answers were regarded as sufficiently reliable for the present study. However, this procedure is of course no guarantee of the reliability desired.

Only 4 out of 10 products examined with a fat content of more than 20% produced accepted answers among women below 50 years of age and only 3 among women aged 50 years and more. None of these high fat products was significantly associated with the breast cancer risk.

Neither in the only previous Polish study on diet and breast cancer could a significant association be found between breast cancer risk and consumption of roasted and boiled meat, lard and bacon (36). The present investigation suggests that the difficulty in obtaining sufficient information about diet many years ago can be one resason for the often negative results of case–control studies concerning association between fat intake and breast cancer risk.

Limited evidence exists of an inverse association between the consumption of vegetables and the risk of breast cancer (33, 36–38). However Ewertz et al. (34) did not find a significant association between breast cancer risk and consumption of vegetables rich in beta-carotene.

The Cracow study is the first one in which a protective effect of boiled vegetables against breast cancer among women aged 50 years and more has been reported.

The risk of breast cancer in this age group significantly decreased with increasing past consumption of boiled vegetables. This suggests that some thermoresistant substances present in boiled vegetables (fiber? indoles? beta carotene?) can be responsible for a protective effect (38).

In order to elucidate the probable association between diet and breast cancer risk, collaboration by epidemiologists at international level is needed, with prospective screening of dietary habits supplemented by some objective diet-related blood parameters. Such studies are at present in progress in several European countries, coordinated by IARC in Lyon.

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