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Diet as Risk for Lung Cancer: A Swedish Case-Control Study

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Abstract: *A case-control study was undertaken to study lung cancer in relation to dietary habits, occupational exposure, and living in urban or country areas. Suspect lung cancer cases in West Sweden and population controls were interviewed using a food frequency questionnaire. The study comprised 177 female and 359 male cases and 916 controls. The cases mainly comprised former and current smokers (82% female, 95% male). For the analysis, cases were divided into the histological diagnoses adenocarcinoma and squamous cell, small cell, and adenosquamous cell carcinomas, as well as into smoking categories. A high frequency of consumption of vegetables was significantly related to a lower risk for adenocarcinoma and squamous cell and adenosquamous cell carcinoma among men and adenocarcinoma among women. A low odds ratio in the highest quartile of vegetable consumption in men was seen in all smoking categories. There were no significant protective effects from fruit in the different lung cancer subgroups, although a significant trend was found for heavy-smoking females. A high consumption of milk was related to an increased risk for lung cancer, especially adenosquamous cell carcinoma. The results suggest that the protective effect or risk due to dietary factors may affect different forms of lung cancer. The results from this as well as previous studies suggest a complex interaction between diet and lung cancer risk, involving the types of lung cancer as well as consumption patterns in the population.*

Introduction

Epidemiological investigations over the years have demonstrated relations between the risk for lung cancer and a variety of environmental factors such as tobacco smoke, occupational exposure, and air pollution. A number of studies demonstrate that dietary factors may influence the risk. A large number of studies has reported a protective effect of fruit and vegetables (1–5). Other studies have, however, not been able to find this protective effect (6). Likewise, fat was found to be a risk factor in one study from Florida (7) but was not a risk factor in the Nurses' Health Study (3). This suggests that the risk for lung cancer is the outcome of a balance between protective and risk factors, which may vary between different populations and even within populations.

The point on population-specific dietary items is illustrated by the results from a study in Japan, where frequent intake of soy beans and tofu was related to a reduced risk and intake of pickles was related to an increased risk (8). There are differences in consumption habits in different populations: the relations with different dietary items could vary in strength, and cultural differences could cause different factors to be of importance. Thus there is a need to perform new studies in other population groups.

The present study is one of the first to evaluate the relation between dietary factors and lung cancer in a representative sample of a Scandinavian population. The study was initiated after reports of an increased risk for lung cancer due to drinking tea (9–11). A case-control study was undertaken to investigate the relation between tea and other dietary items and the risk for lung cancer in a Swedish population. In addition to dietary factors, other potential risk factors in terms of tobacco smoking, occupational exposure, residential area as gross indicator of air pollution, and keeping birds were studied. In previous reports, data from some of the men in the study (12,13) and data on bird keeping (14) have been presented. This report comprises data from the whole material and includes women and men.

Materials and Methods

Study Population and Case-Control Selection

The study comprised lung cancer patients who were ≤75 yr of age and of Scandinavian birth who lived in 1 of 26 municipalities in Gothenburg and Bohus County and Älvsborg County in southwest Sweden at the time of the study. The municipalities represented a mixture of urban and rural areas. Three hospitals in the region cover >90% of the lung cancer cases in the Gothenburg-Bohus County area and 75% in Älvsborg. Patients who were referred to one of these hospitals with suspected lung cancer (usually on the basis of lung X-ray findings) were invited to participate in the study.

The project was described as a research project aimed at studying the relation between environmental factors and lung disease. Patients who were willing to participate in the pro-

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ject were immediately contacted, and an appointment for an interview was made. For each patient who had suspected lung cancer, we used population registers to select the control. In each county, we chose the person following the case in the register who was of the same gender and closest in birth date (usually a few days apart from the case). If this person was an immigrant, the next available control was selected.

Of the 474 women and 732 men with suspected lung cancer, 389 (82%) and 646 (88%), respectively, were interviewed. Of the 171 patients (14%) who were not interviewed, 77 had agreed to participate but were too ill to undergo the interview, 9 were not asked on the grounds of mental disease, and 85 declined. Among the 474 women and 732 men who were approached as controls, 340 (72%) and 574 (78%) were interviewed; 79 (7%) declined because of ill health, 106 (9%) refused without giving a reason, and 108 (9%) did not answer the invitation letter or telephone call.

The suspected cases as well as the population controls were matched with the regional cancer registry at Oncological Center, Sahlgrenska University Hospital. The suspected cases were classified as lung cancer cases (ICD7, 162.1) only if they were included under that diagnosis in the registry. Of the 389 women and 646 men with suspected cancer who were interviewed, 177 (46%) women and 359 (56%) men were later diagnosed as having primary lung cancer. The basis for the diagnosis was histological examination of surgical or biopsy material in 98% of the cases. Patients who did not have this diagnosis were excluded from the analysis and not used as controls. Of those who were too ill to participate or who declined, 55% of the women and 47% of the men were later diagnosed as having primary lung cancer. Three men who were interviewed as population controls received the diagnosis of lung cancer ~1 yr after the interview and were reclassified as cases. In the analyses, the lung cancer cases were divided into the histological diagnoses adenocarcinoma and squamous cell, small cell, and adenosquamous cell carcinoma. The remaining cases (27 women and 26 men) were spread among several different diagnoses, too small to allow for a meaningful analysis.

Questionnaire

The questionnaire included questions on smoking, environmental tobacco smoke, occupational exposures, conditions in the residential area (local air pollution), and dietary habits. The latter were investigated using a food frequency questionnaire that covered the intake of >80 food items. The frequency questions were "seldom or never," "once or twice per month," "once or twice per week," "daily or almost daily," and, for commonly used food items, "several times per day … how many?" The respondents were encouraged to think about how they had eaten during the past 12-mo period on average and whether (and if so when) they had changed their eating habits drastically during the past 20 yr (drastic change defined as consumption changed over 2 frequency groups or from "daily" to "several times daily"). In the analyses, the data for food intake 3 yr before the interview were used. The questionnaires were not validated, inasmuch as the questions were very similar to those used in other studies.

Interviews

The patients were interviewed at the hospitals within a few days after referral to the department. Two nurses specially trained for the project performed all interviews, which were generally conducted before the diagnosis was established. The interview took ~45 min, and the two nurses alternated between interviewing controls and suspected cases to avoid bias. Interviews with controls usually took place at the department or in their homes, within 4–8 wk of the corresponding patient's interview.

The recruitment of patients started in January 1989 and ended in June 1994. There were breaks each summer between June and September as well as an interruption between May 1992 and February 1993. The analyses in this article include all lung cancer cases and population controls interviewed in the study.

Statistical Treatment of Data

For estimation of odds ratios (ORs), logistic regression models were used (SPSS package). The risks were related to the histological diagnoses adenocarcinoma and squamous cell, small cell, and adenosquamous cell carcinomas. In all analyses, adjustments were made for age (continuous variable), number of cigarettes smoked per day (4 classes) and number of years smoked (5 classes), marital status (4 classes), and consumption of vegetables, fruits, and milk. (One gram of pipe tobacco was considered to be equal to one cigarette.) Those who had stopped smoking in the 4 yr before the interview were classified as current smokers.

The food frequency categories were converted to times per week (seldom or never = 0, once or twice/mo = 0.4, once or twice/wk = 1.5, and daily or almost daily = 6). A group of vegetables was formed by summation of the weekly intake of the most frequently used vegetables, i.e., tomatoes, cabbage, carrot, lettuce, and green and red pepper. Four subgroups of consumption were created by dividing the subjects into groups that contained about equal numbers of subjects. The most frequently consumed fruits were citrus fruit, banana, and other fruits and berries, except apricots and rose bud soup. The intake frequency was treated the same way as the vegetables. For milk, the material was divided into three classes (twice/wk or less, daily or almost daily, and several times/day).

Results

Table 1 presents the patient and population control characteristics. Differences between cases and controls were found for marital status, socioeconomic job classification for men, smoking duration, and number of cigarettes smoked.

Table 1. Characteristics of Women and Men With Lung Cancer and Population Controls[a]

	Women		Men	
	Cases (n = 177)	Controls (n = 342)	Cases (n = 359)	Controls (n = 574)
Age, yr				
<50	21 (12)	37 (11)	18 (5)	46 (8)
50–59	24 (14)	74 (22)	70 (19)	109 (19)
60–69	81 (46)	137 (40)	163 (45)	248 (43)
70–75	51 (29)	94 (27)	108 (30)	171 (30)
Marital status				
Married	99 (56)	225 (66)	261 (73)	456 (79)
Widowed	34 (19)	63 (18)	25 (7)	32 (6)
Divorced	32 (18)	26 (8)	40 (11)	36 (6)
Never married	12 (7)	28 (8)	33 (9)	50 (9)
Job classification				
Higher civil servants and executives	6 (3)	12 (4)	30 (8)	88 (15)
Farmers/housewives	6 (3)	19 (6)	4 (1)	15 (3)
Self-employed	3 (2)	10 (3)	38 (11)	56 (10)
Intermediate nonmanual employees	22 (12)	44 (13)	48 (13)	106 (18)
Assistant nonmanual employees	38 (21)	97 (28)	55 (15)	82 (14)
Skilled workers	16 (9)	19 (6)	101 (28)	127 (22)
Unskilled and semiskilled workers	86 (49)	141 (41)	83 (23)	100 (17)
Smoking history				
Never smoker	31 (18)	202 (59)	18 (5)	182 (32)
Former smoker	19 (11)	48 (14)	84 (23)	220 (38)
Current smoker	127 (72)	92 (27)	257 (72)	172 (30)
Smoking duration, yr				
1–19	8 (5)	27 (19)	14 (4)	101 (26)
20–29	15 (10)	35 (25)	22 (6)	72 (18)
30–39	35 (24)	35 (25)	67 (20)	75 (19)
40–49	60 (41)	30 (21)	121 (35)	97 (25)
≥50	28 (19)	13 (9)	117 (34)	47 (12)
Cigarettes smoked/day				
1–9	26 (18)	53 (38)	40 (12)	110 (28)
10–19	80 (55)	63 (45)	128 (38)	141 (36)
≥20	40 (27)	24 (17)	173 (51)	141 (36)

a: Values are numbers of subjects, with percentages in parentheses.

These factors were later included in the logistic regression correction of ORs. The basis for diagnosis was autopsy or tissue histology or cytology in 99% of the cases. There were no differences in the distribution of histological subclasses between patients who were interviewed and those who were not.

Table 2 reports the average frequency of consumption of vegetables, fruits, and milk among female and male controls and cases. Female and male cases consumed vegetables and fruit less frequently than the controls and consumed milk more often. Women had a more frequent consumption of vegetables and fruit and a less frequent consumption of milk then men. The frequency of vegetable and fruit consumption was about the same among female and male controls.

Tables 3 and 4 report ORs for different forms of lung cancer with reference to consumption of vegetables in the four frequency groups. For women (Table 3), no protective effect was found if all diagnoses were considered together. For the different diagnoses, there was a protective effect against adenocarcinoma, but not for the other diagnoses. A significant trend was found among never smokers, but not among smokers. For men (Table 4), there was a strong protective effect for adenocarcinoma and for squamous cell and adenosquamous cell carcinomas. The protective effect in the highest quartile was present in all smoking categories. In view of the covariation between the different vegetable items, it was not possible to determine with certainty the particular vegetable that was most efficient, but the analysis suggests that cabbage and red and green pepper were particularly powerful.

Table 2. Average Frequency of Consumption of Different Food Items Among Female and Male Cases and Controls[a]

	Women		Men	
Item	Cases	Controls	Cases	Controls
Vegetable	8.2	10.1	6.3	8.8
Fruit	9.3	12.5	7.9	9.8
Milk	10.6	7.7	11.4	9.0
Tea	2.6	2.6	3.1	3.1

a: Values are times/wk.

Table 5 demonstrates ORs in relation to the consumption of fruit. Among women, there was a protective effect of borderline significance in the fourth quartile if all diagnoses were analyzed together. For individual diagnoses, there was a slight protective effect for adenosquamous cell carcinoma,

Table 3. ORs and 95% CIs for Lung Cancer Among Women in Relation to Weekly Consumption of Vegetables[a,b]

	Cases (*n* = 177)	Controls (*n* = 342)	All (*n* = 177)	Carcinoma[c] Adeno (*n* = 53)	Squamous (*n* = 49)	Small Cell (*n* = 34)	Adenosquamous (*n* = 16)
Q1	57	74	1	1	1	1	1
Q2	53	78	1.1 (0.6–2.0)	0.7 (0.3–1.6)	2.2 (0.8–6.2)	1.3 (0.4–4.0)	1.2 (0.2–6.0)
Q3	38	99	0.7 (0.4–1.3)	0.5 (0.2–1.1)	1.2 (0.4–3.8)	1.2 (0.4–3.7)	0.7 (0.1–3.7)
Q4	29	91	0.8 (0.4–1.5)	0.4 (0.1–1.0)	2.3 (0.7–7.3)	0.3 (0.1–1.7)	1.1 (0.2–6.1)
P for trend			0.230	0.025	0.301	0.354	0.892
				Number Of Cigarettes/Day[d,e]			
	Cases (*n* = 177)	Controls (*n* = 342)	All (*n* = 177)	Never Smokers (*n* = 31)	1–9 (*n* = 26)	10–19 (*n* = 80)	≥20 (*n* = 40)
Q1	57	74	1	1	1	1	1
Q2	53	78	1.1 (0.6–2.0)	0.6 (0.2–1.8)	1.7 (0.3–10.2)	1.1 (0.4–3.0)	6.1 (0.7–57.3)
Q3	38	99	0.7 (0.4–1.3)	0.3 (0.1–0.9)	1.0 (0.2–4.6)	1.0 (0.3–3.2)	0.9 (0.2–4.5)
Q4	29	91	0.8 (0.4–1.5)	0.4 (0.1–1.3)	1.8 (0.4–8.6)	0.9 (0.3–2.9)	0.4 (0.1–3.7)
P for trend			0.230	0.048	0.599	0.791	0.486

a: OR, odds ratio; CI, confidence interval.
b: Interquartile ranges for weekly intake of vegetables were 0–4.0, 4.1–8.9, 9.0–14.1, and ≥14.2 times/week.
c: Data adjusted for age, marital status, smoking duration, number of cigarettes/day, and fruit and milk consumption.
d: Data adjusted for age, marital status, smoking duration, and fruit and milk consumption.
e: Previous and current smokers.

Table 4. ORs and 95% CIs for Lung Cancer Among Men in Relation to Weekly Consumption of Vegetables[a]

	Cases (*n* = 359)	Controls (*n* = 574)	All (*n* = 359)	Carcinoma[b] Adeno (*n* = 83)	Squamous (*n* = 158)	Small Cell (*n* = 58)	Adenosquamous (*n* = 36)
Q1	132	102	1	1	1	1	1
Q2	86	150	0.7 (0.4–1.0)	0.6 (0.3–1.2)	0.5 (0.3–1.0)	0.8 (0.3–1.8)	0.5 (0.2–1.4)
Q3	84	147	0.7 (0.4–1.0)	0.4 (0.2–0.9)	0.9 (0.5–1.6)	0.6 (0.2–1.4)	0.5 (0.2–1.4)
Q4	57	175	0.4 (0.2–0.6)	0.3 (0.1–0.7)	0.4 (0.2–0.8)	0.4 (0.2–1.1)	0.3 (0.1–0.9)
P for trend			<0.001	0.003	0.039	0.056	0.038
				No. of Cigarettes/Day[c,d]			
	Cases (*n* = 359)	Controls (*n* = 574)	All (*n* = 359)	Never Smokers (*n* = 18)	1–9 (*n* = 40)	10–19 (*n* = 128)	≥20 (*n* = 173)
Q1	132	102	1	1	1	1	1
Q2	86	150	0.7 (0.4–1.0)	2.8 (0.6–14.5)	0.6 (0.2–1.8)	0.4 (0.2–0.8)	0.8 (0.4–1.7)
Q3	84	147	0.7 (0.4–1.0)	1.5 (0.3–9.0)	0.4 (0.1–1.5)	0.5 (0.2–1.1)	0.8 (0.4–1.8)
Q4	57	175	0.4 (0.2–0.6)	0.5 (0.1–4.1)	0.2 (0.1–1.0)	0.4 (0.2–1.0)	0.4 (0.2–0.9)
P for trend			<0.001	0.197	0.044	0.111	0.029

a: Data adjusted for age, marital status, smoking duration, number of cigarettes/day, and vegetable and milk consumption.
b: Interquartile ranges for weekly intake of vegetables were 0–3.0, 3.01–7.0, 7.1–11.9, and ≥12.0 times/wk.
c: Data adjusted for age, marital status, smoking duration, number of cigarettes/day, and consumption of fruit and milk.
d: Previous and current smokers.

although the decrease in risk did not attain statistical significance, either in the different consumption groups or calculated as a trend. Among men, there were no significant protective effects for all cases or the individual diagnosis. There were no significant trends in the different smoking categories for women or men (data not shown).

Table 6 reports ORs for lung cancer risk in relation to frequency of milk consumption. Among women, there was a significantly increased risk for all cases. For the individual diagnoses, there was a pronounced increased risk for adenosquamous cell carcinomas but not for the other histological types. For men, the trend was significant if all diagnoses were analyzed together. There was a significantly increased risk for adenocarcinoma and squamous cell and adenosquamous cell carcinoma. A significant trend for men ($P = 0.001$) was found in the highest smoking category.

Table 5. ORs and 95% CIs for Lung Cancer Among Women and Men in Relation to the Weekly Consumption of Fruit[a]

	Cases (n = 177)	Controls (n = 342)	All (n = 177)	Carcinoma: Adeno (n = 53)	Squamous (n = 49)	Small Cell (n = 34)	Adenosquamous (n = 16)
Women[b]							
Q1	55	73	1	1	1	1	1
Q2	51	76	1.1 (0.6–1.9)	0.8 (0.3–1.9)	0.8 (0.3–2.2)	4.7 (1.2–1.8)	1.1 (0.2–5.2)
Q3	51	118	0.8 (0.4–1.4)	0.8 (0.4–1.8)	0.5 (0.2–1.4)	2.8 (0.8–10)	0.5 (0.1–2.6)
Q4	20	75	0.5 (0.2–1.0)	0.6 (0.2–1.7)	0.5 (0.2–1.6)	1.3 (0.3–7.2)	0.1 (0.1–1.5)
P for trend			0.046	0.382	0.152	0.745	0.069
	Cases (n = 359)	Controls (n = 574)	All (n = 359)	Carcinoma: Adeno (n = 83)	Squamous (n = 158)	Small Cell (n = 58)	Adenosquamous (n = 36)
Men[c]							
Q1	117	132	1	1	1	1	1
Q2	98	125	1.0 (0.6–1.5)	0.8 (0.4–1.7)	0.7 (0.4–1.3)	1.2 (0.5–2.7)	1.3 (0.5–3.4)
Q3	64	130	0.8 (0.5–1.3)	0.9 (0.4–1.8)	0.7 (0.4–1.4)	1.4 (0.6–3.4)	0.7 (0.2–2.2)
Q4	80	187	0.8 (0.5–1.2)	0.8 (0.4–1.7)	0.6 (0.3–1.1)	1.0 (0.4–2.5)	0.6 (0.2–2.0)
P for trend			0.186	0.574	0.144	0.904	0.296

a: Data adjusted for age, marital status, smoking duration, number of cigarettes/day, and vegetable and milk consumption.
b: Interquartile ranges for weekly intake of fruit were 0–7.4, 7.5–11.9, 12.0–14.9, and ≥15.0 times/wk.
c: Interquartile ranges for weekly intake of fruit were 0–4.4, 4.5–8.9, 9.0–13.4, and ≥13.5 times/wk.

Table 6. ORs 95% CIs for Lung Cancer Among Women and Men in Relation to Consumption of Milk[a,b]

	Cases (n = 177)	Controls (n = 342)	All (n = 177)	Carcinoma: Adeno (n = 53)	Squamous (n = 49)	Small Cell (n = 34)	Adenosquamous (n = 16)
Women							
Low	39	106	1	1	1	1	1
Middle	66	140	1.0 (0.6–1.8)	0.8 (0.4–1.7)	1.4 (0.5–3.7)	1.9 (0.6–5.9)	3.7 (0.4–36)
High	72	96	1.9 (1.1–3.3)	1.0 (0.4–2.2)	2.2 (0.8–6.1)	1.6 (0.5–5.4)	6.3 (0.6–61)
P for trend			0.024	0.953	0.129	0.506	0.094
	Cases (n = 359)	Controls (n = 574)	All (n = 359)	Carcinoma: Adeno (n = 81)	Squamous (n = 158)	Small Cell (n = 58)	Adenosquamous (n = 36)
Men							
Low	75	168	1	1	1	1	1
Middle	117	209	1.4 (0.9–2.1)	1.5 (0.8–3.0)	1.3 (0.7–2.2)	0.9 (0.4–2.1)	3.8 (1.0–14)
High	167	197	1.9 (1.3–2.9)	2.0 (1.0–3.0)	1.8 (1.0–3.0)	1.7 (0.8–3.7)	5.9 (1.7–21)
P for trend			0.001	0.035	0.034	0.110	0.004

a: Low, ≤2 times/wk, middle, daily, or almost daily; high, several times/day.
b: Data adjusted for age, marital status, smoking duration, number of cigarettes/day, and vegetable and fruit consumption.

No relationship could be demonstrated between the frequency of tea consumption and risk for lung cancer (data not shown). An occupational exposure of a kind known to be related to an increased risk for lung cancer was found among 6% of the male cases and 10% of the controls. It was thus not likely that occupational exposure contributed to the risks. No differences were found in lung cancer risk between persons living in rural, suburban, or city areas. The number of never-smoking cases was too small to allow for an analysis of the relation to environmental tobacco smoke.

Discussion

According to the cancer registry, 93 male lung cancer cases were diagnosed at the participating clinics in the study base during the 1st yr of the study. Only six of these (6.5%) had visited one of the three participating clinics without being identified as a suspected case. In addition, the rate of participation among the patients with suspected lung cancer was high (88%). The lung cancer cases in the study can thus be considered representative for the cases in the study population base. The participation rate of population controls was also high and exceeded that of many previous studies. New persons did not substitute for nonresponding controls. The controls used in this study are thus likely to be representative of the study base.

All information in the study was collected by personal interviews of cases and controls. This information is more accurate than information from proxy respondents, which can induce errors in the interpretation of data, as shown by Swanson et al. (15). Self-reported consumption is, however, open to bias, particularly from persons who suspect that they have a serious disease. This is an error that cannot be avoided in studies of this kind. Reference was made to dietary habits 3 yr before the interview to reduce the risk of influence of the situation at the time of the interview in terms of such factors as stage of the disease and weight loss.

The results from this investigation support findings of several previous studies that the consumption of vegetables is associated with a reduced risk for lung cancer (1). There was a more pronounced association among men. This might be because average consumption of vegetables was lower in men than in women. In a previous study of nonsmoking female lung cancer cases in Sweden, only a tendency to a protective effect was found for vegetables (16).

Regarding fruit, there was a significant trend in women if the different forms were evaluated together, but there was only a slight nonsignificant tendency to a protective effect for individual diagnoses. This is contradictory to the results from the study mentioned above, where consumption of fruit other than citrus fruit was significantly associated with a reduced lung cancer risk (16). However, a review of other studies also reported inconsistencies in the protective effects (17). One reason for such differences might be that the consumption habits were different. Another reason for this inconsistency and for inconsistency in the results from other studies regarding the protective effects of vegetables and fruit between studies could be the lack of adjustment in a logistic regression model. As an example, the crude OR for fruit consumption among men in this study was 0.5 in the highest consumption group (P for trend < 0.001), but after adjustment for smoking, age, marital status, and consumption of vegetables and milk, the OR became 0.8 (not significant).

A tendency to an increased risk related to milk consumption was present among women as well as men, and this was due to a significantly increased risk for adenosquamous cell carcinoma. In previous studies, an increased risk related to milk consumption has also been reported (16,18–20). Contradictory data have been presented in two studies from Norway. In a follow-up study on 168 cases of lung cancer, milk was found to be a protective factor (21). The authors attributed this finding to the vitamin A content of the milk. A later follow-up study comprising 153 cases of lung cancer reported a decreased risk for consumption of skim milk compared with whole milk and an increased risk for consumption of mono- and polyunsaturated fats (22).

The different outcome of lung cancer risk related to milk consumption in different studies could thus reflect the balance between vitamin A and fat supply, the final outcome being determined by the presence of other sources of these nutrients in the diet of the particular population studied. In Sweden, milk was an important source of fat, inasmuch as whole milk was a staple drink taken with one or more meals each day. Support for the fat hypothesis is found in epidemiological studies where a relation between the consumption of saturated fat and an increased risk for lung cancer has been found (23–28). However, some studies have not found an association with fat (29,30). The consumption of whole milk in Sweden has decreased, inasmuch as there has been a shift in the consumption habits toward low-fat milk in the Swedish population. If the fat hypothesis is correct, this should lead to a reduction in the risk for lung cancer attributable to milk consumption during coming decades, provided that the milk consumption does not increase.

The results suggest that protective and risk factors were, to a certain extent, specific for the type of lung cancer studied. The protective effect of vegetables was most pronounced for adenocarcinoma among men and women, but a similar tendency was also present for other histological groups among men. The increased risk for milk was related to adenosquamous cell carcinomas. Obviously, the histopathological diagnosis of lung cancer comprises important methodological errors, but the material in this study was evaluated at the same pathological center, minimizing the risk for selective misclassification.

The results from the study suggest that an analysis of the relation between environmental factors and lung cancer taking different diagnoses into consideration will give different weight to a specific diagnosis depending on the agent evaluated. Such differences in histological types could relate to differences in the pathology behind the development of different tumors and could be used as a basis for metabolic and other mechanistic studies.

This study could not demonstrate an increased risk for tea consumption, contrary to some previous studies (9,10). Those studies were, however, performed among populations with a generally high consumption of tea and related a risk to green tea, whereas the consumption in Sweden is relatively low and mainly consists of black tea. Goldbohm et al. (31) reported from a prospective cohort study on black tea consumption and lung cancer risk that no support was found, either for an increased risk or a protective effect among high consumers. In a study of 427 cases of lung cancer in Uruguay (32), a reduced risk for lung cancer was found among those consuming two or more cups of tea per day after adjustment for smoking. The effects were, however, based on small numbers (2 cases and 36 controls). There thus seems to be very little support for the hypothesis that moderate tea consumption is a risk factor for lung cancer today.

In conclusion, the major result emerging from the study is a protective effect of vegetables against adenocarcinomas among women as well as men and an increased risk for adenosquamous cell carcinomas in relation to high milk consumption. These results are consistent with many similar studies. The absence of a clear protective effect of fruit has been shown in previous studies and may reflect a complexity in dietary risk factors that does not translate into simple relationships and where studies in populations with different consumption habits will yield different results. It is likely that the effects of protective factors and those that increase risk reflect complicated cellular mechanism relating to different kinds of lung tumors. Further studies are thus needed to explore such mechanisms, and intervention studies with specific dietary items could be a useful tool in this work.

Acknowledgments and Notes

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