

CORRESPONDENCE

Joint Effect of Diet and Environmental Tobacco Smoke on Risk of Lung Cancer Among Nonsmokers

A recent meta-analysis based on 4626 cases concluded that the relative risk of lung cancer in lifelong nonsmokers who lived with a smoker was 1.24 (95% confidence interval [CI] = 1.13–1.36) (1). Subsequently, we reported in the Journal (2) the results from a large case-control study of environmental tobacco smoke (ETS) and lung cancer based in 12 European centers. This study provided an odds ratio (OR) for lung cancer of 1.14 (95% CI = 0.88–1.47) for spousal and workplace exposure to ETS; the increase was most apparent among those in the top quartile of exposure (OR = 1.31; 95% CI = 0.88–1.94) and the top decile of exposure (OR = 1.46; 95% CI = 0.96–2.22) (*P* value for trend = .01). It could be argued that such increased risks associated with ETS might not represent a causal effect but may be due to confounding by dietary factors. To further elucidate this critical issue, we have analyzed the data of the European study by examining the joint relationship between dietary consumption, exposure to ETS, and lung cancer.

Eight of the 12 centers have collected detailed food-frequency information on both case patients and control subjects,

including information on intake of various fruits and vegetables, allowing weighted estimates of intake of several carotenoids combined (α -carotene, β -carotene, lutein, zeaxanthin, and lycopene), β -carotene alone, and retinol to be calculated (3). Dietary variables that showed a protective effect for lung cancer in the overall analysis and that were available for a majority of the centers included fruit, lettuce, tomato, carrot, and cheese consumption as well as intake of carotenoids, β -carotene, and retinol (3). To enable direct comparisons, the ORs for combined spousal and workplace exposures to high levels of ETS (upper quartile versus lower three quartiles) were calculated for the subset of centers with dietary information. The ORs for high ETS exposure were 1.40 in all eight centers (95% CI = 1.05–1.88), 1.36 in seven centers with information on fruit consumption (95% CI = 1.01–1.83), 1.32 in seven centers with information on lettuce consumption (95% CI = 0.97–1.81), 1.58 in seven centers with information on carotene consumption (95% CI = 1.20–2.08), and 1.16 in the five centers with information on tomato consumption (95% CI = 0.77–1.75).

Table 1 reports the results of the analysis. Increased ORs for ETS were consistently observed both among subjects with high dietary consumption (OR in the fifth column versus those in the third column) and among subjects with low dietary consumption (OR in the sixth column versus OR in the fourth column), indicating no confounding by dietary items in the association between ETS and lung cancer. In addition, the highest ORs were observed when com-

paring the two extreme categories, i.e., subjects with low dietary consumption and high ETS exposure (sixth column) versus subjects with high dietary consumption and low ETS exposure (third column). These results add weight to the causal interpretation of the association between ETS and lung cancer, as one would not expect to find this mutual enhancement effect of ETS and dietary items if the ETS association with lung cancer were an artifact. At the same time, the results suggest that the combination of these two common risk factors can increase the risk of lung cancer among nonsmokers by as much as twofold.

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Table 1. Joint effect of dietary consumption and environmental tobacco smoke exposure on risk of lung cancer among nonsmokers*

Variable	No. of centers with data (No. of case subjects : No. of control subjects)	High dietary consumption and low ETS exposure (referent)	Low dietary consumption and low ETS exposure, OR (95% CI)	High dietary consumption and high ETS exposure, OR (95% CI)	Low dietary consumption and high ETS exposure, OR (95% CI)
Fruit	7 (475 : 895)	1.00	1.02 (0.68–1.54)	1.32 (0.87–2.01)	1.40 (0.79–2.48)
Lettuce	7 (428 : 916)	1.00	1.33 (0.78–2.26)	1.35 (0.79–2.32)	2.25 (1.02–4.99)
Tomato	5 (256 : 599)	1.00	1.54 (0.87–2.73)	1.08 (0.53–2.20)	1.67 (0.71–3.92)
Carrot	8 (501 : 1036)	1.00	1.10 (0.69–1.75)	1.52 (0.85–2.71)	1.93 (1.13–3.29)
Cheese	8 (496 : 1030)	1.00	1.26 (0.84–1.89)	1.29 (0.84–1.97)	1.54 (0.85–2.81)
Carotenoids	7 (425 : 885)	1.00	0.92 (0.60–1.41)	1.20 (0.71–2.04)	1.71 (0.99–2.95)
β -carotene	8 (502 : 1036)	1.00	1.13 (0.77–1.65)	1.29 (0.82–2.04)	1.90 (1.16–3.12)
Retinol	8 (502 : 1036)	1.00	1.00 (0.69–1.45)	1.50 (0.94–2.39)	1.63 (0.97–2.72)

*ETS = environmental tobacco smoke; OR = odds ratio; CI = confidence interval. All ORs were adjusted by center, age, and sex. High ETS exposure is defined as being in the upper quartile of ETS exposure from both spousal and workplace sources (duration \times number of hours/day). High dietary consumption for each food item is defined as being in the upper third for frequency of consumption (usually daily or almost daily). Low dietary consumption for each food item is defined as being in the lower third for frequency of consumption (usually less than once a week).

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NOTES

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