



Original article

The consumption of coffee and black tea and the risk of lung cancer

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ABSTRACT

Purpose: Coffee and black tea are among the most consumed beverages worldwide. Although their potential role in lung cancer occurrence has been investigated in several studies, results have been inconclusive. We investigated the associations between intake of coffee and black tea with lung cancer in a population-based case–control study in Montreal, Canada.

Methods: These analyses included 1130 cases and 1483 controls. Adjusted odds ratios (ORs) were estimated between four metrics of coffee and black tea consumption (frequency, average daily amount, duration, and cumulative amount) and lung cancer, using unconditional logistic regression.

Results: The adjusted ORs (95% confidence intervals) for lung cancer comparing daily to never consumers were 0.73 (0.49–1.10) for coffee and 1.05 (0.85–1.31) for black tea. Analyses of other metrics did not reveal any clear patterns of increasing or decreasing risk with increasing amounts or duration of consumption. There was no strong evidence of OR modification by sex or smoking level. The OR estimates did not materially differ by histological subtype for either of the beverages.

Conclusion: Our results do not provide strong support for associations between consumption of coffee and black tea and lung cancer.

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Introduction

Coffee and tea, which are consumed worldwide by billions of individuals, may contribute to lung cancer risk. Both beverages are composed of hundreds of chemicals, some of which may reduce risk while others may increase it. For instance, catechins, found in tea, and chlorogenic acid, present in coffee, are antioxidants that could reduce lung cancer risk [1–4]. Caffeine, present in both coffee and tea, could increase risk via activation of proteins involved in various regulatory signal transduction pathways [5].

In a systematic review of the literature published through 2006, the available evidence on the associations between consumption of coffee and tea and lung cancer was judged to be limited and inconclusive [6]. In two subsequently published meta-analyses [7,8], the evidence was consistent with no association between black tea consumption and lung cancer, although in one

of these, statistically significant heterogeneity between studies was reported [7]. In subsequently published meta-analyses [8–11] and individual studies [12,13] of coffee intake, positive associations were reported in all but one individual study [11]; statistically significant heterogeneity between studies was reported in two of the meta-analyses [9,10].

Residual confounding by smoking may have affected the results in some studies of both coffee and black tea. For instance, in two of the meta-analyses that reported positive associations with coffee consumption, inverse associations were suggested among never smokers [9,10]. Also, only a few studies [14–17] have adjusted for occupational exposure to lung carcinogens, one of the most important lung cancer risk factors after smoking [18]. Furthermore, lifetime duration of consumption of these beverages might be an important aspect in the association with lung cancer risk, but to our knowledge, only one study has examined duration [16].

In the context of a large population-based case–control study of lung cancer carried out in Montreal, Canada, we examined the association between coffee and black tea consumption and lung cancer risk overall, by sex and smoking level, as well as separately according to histological subtype.

The authors have no conflicts of interest to disclose.

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Material and methods

Study population

The design of the study has been described previously [19]. Briefly, participants were recruited from 1996 to 2001 and included Canadian citizens aged 35–75 years who resided in the greater Montreal area. Incident lung cancer cases were identified in the 18 major hospitals serving the study region, and controls were selected from the Quebec voter registration list and frequency matched to the cases by 5-year age group and sex. The response rate was 85% among cases and 69% among controls. The current analysis was limited to participants with complete information on their consumption of either coffee or tea, and on their smoking habits ($n = 1111$ cases and 1469 controls in the analysis of tea, and 1009 cases and 1434 controls in the analysis of coffee). Written informed consent was obtained from participants, and the study was approved by the Institutional Review Boards of participating universities and hospitals.

Data collection

Study participants or their proxies (for 389 cases and 103 controls) participated in a face-to-face interview that was divided into two parts. The first part was a structured section during which data on sociodemographic characteristics (including ethnic group and highest level of schooling) and lifestyle (including coffee and tea intake, alcohol intake, other dietary factors, smoking, and physical activities) were collected. In the second part, a detailed description of lifetime occupational history was collected [19]. Participants' occupational histories were subsequently assessed by expert chemists and industrial hygienists to determine lifetime occupational exposure to a list of nearly 300 agents [20–23]. Family income was represented by the median family income level for the census tract the participant lived in at the time of interview.

For tea and coffee consumption, participants were first asked if they drank the beverage at least once a week and if yes, they were then asked if they drank it nearly every day. For participants who reported drinking the beverage nearly every day, further questions were asked that assessed the age at which they started and stopped consumption, as was the average daily amount consumed (in cups) during the time that they were consumers. The specific type of tea consumed was not assessed, however, in the birth cohort of our participants (most born around 1920–1950), lifetime tea consumption was predominantly black tea. Black tea has historically been the dominant type consumed in North America [24]; in Canada, significant green tea importation began only in the late 1990s (reaching 17% of total tea imported in 2009 [25]). Similarly, our questionnaire did not differentiate between caffeinated and decaffeinated coffee; however, only around 8% of coffee consumed in Canada in 2010 was decaffeinated [26], and this proportion was likely much lower in the past. Thus, coffee consumption in our study population likely represents primarily caffeinated consumption.

Study variables

Four metrics were used to summarize lifetime coffee and black tea consumption including (1) frequency of consumption, (2) average daily amount, (3) duration of consumption, and (4) cumulative amount. For frequency of consumption, participants were categorized as “never” consumers if they reported not drinking coffee and/or black tea at least once per week during their life; “weekly, not daily” consumers if they reported drinking coffee and/or black tea at least once per week but not nearly every day;

and “daily” consumers if they reported drinking coffee and/or black tea nearly every day. Among “daily” consumers, categorical variables of average daily amount of consumption, duration of consumption, and cumulative consumption, which incorporated measures of both daily amount and duration of consumption, were defined. Duration of consumption was calculated by subtracting the age at which participants started consuming the beverage from the age at which they stopped. To minimize the risk of reverse-causality bias, consumption during the 2 years preceding the diagnosis date for cases or the interview date for controls were not included in the calculation of duration of consumption.

Data on consumption of wine were collected in a similar manner to that of coffee and black tea intake and represented by a categorical variable. Lifetime history of cigarette smoking was represented by the comprehensive smoking index (CSI) [27], which is a continuous variable that incorporates information on smoking status, duration of smoking, time since the cessation of smoking, and average daily intensity of smoking. Exposure to seven known occupational lung carcinogens (asbestos, crystalline silica, chromium VI compound, nickel compounds, benzo(a)pyrene, cadmium compounds, and diesel engine emissions) was represented by a categorical variable defining participants as never exposed, exposed to at least one of the seven carcinogens but only at non-substantial levels or exposed to at least one of the seven carcinogens at substantial levels. For a given occupational carcinogen, substantial exposure was defined as exposure to a medium- or high-level concentration for at least 5 years and for at least 2 hours per week, while nonsubstantial exposure was defined as exposure to a low concentration and/or shorter duration of exposure. Categorical variables were used to represent ethnic group and number of years of schooling. Family income was represented by tertiles.

Statistical analysis

The distribution of study variables was examined by case and/or control status. To assess the association between each metric of coffee or black tea consumption and lung cancer, odds ratios (ORs) and 95% confidence intervals (CI) were estimated using unconditional logistic regression. Multivariable models included the frequency matching variables (age and sex) and covariates that were identified *a priori* based on their known association with lung cancer: ethnicity, family income (from median of census tract), years of education, smoking (CSI), and occupational exposure to lung carcinogens. Each model was also adjusted for respondent status (self/proxy). In addition, we considered potential confounding by exposure to other dietary variables (i.e., fruits and vegetables, wine, beer, and spirits), by entering each variable individually and retaining the variable if the OR changed by at least 10%. Only the variable for wine intake was retained, and in nine cases and two controls with missing values, the modal value among controls (never drinker) was used.

Modification of the ORs for coffee or black tea consumption and lung cancer risk by sex or by smoking level was evaluated by including in the models product terms for the consumption metric and the potential effect modifier. The *P* for multiplicative interaction was based on the likelihood ratio test comparing the models with and without the product terms. Smoking level was categorized as never, light, and heavy, where light smoking and heavy smoking were defined based on dichotomizing at the median CSI value (1.928) among all ever smokers in the study population. Because there were few cases in the never-smoking category (47 cases), never smoking and light smoking were combined into one category. Within each level of smoking, models were still adjusted for the continuous CSI variable.

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