Effect of Coffee and Tea Consumption on Oral Cancer Risk: A Meta-Analysis

Abstract

Background: Oral cancer is a global public health problem whose incidence and mortality have not considerably improved in recent decades. Its etiology is multifactorial with risk factors such as smoking, alcohol intake, human papillomavirus infection, or dietary factors. Objectives: The objective is to assess the possible effect of coffee and/or tea consumption on oral cancer. Methods: A PubMed database search through December 2018 of articles on the effect of coffee or tea consumption on oral cancer using the following Medical Subject Headings terms (“coffee” or “tea”) and “mouth neoplasms” was conducted. One hundred and two articles were found between 1990 and 2017. From 79 studies with full-text availability, 61 were excluded for several reasons: studies on cancers that did not exclusively affect the oral cavity (29) and studies with non-useable data (32).

Statistical Analysis: For dichotomous outcomes, the estimates of effects of an intervention were expressed as odds ratios (ORs) using Mantel-Haenszel method with a 95% confidence interval and, also the Pearson Chi-square test was applied when required. Results: Eighteen studies on the effect of coffee and/or tea consumption on oral cancer were included in this meta-analysis. High consumption of coffee (≥6 cups daily) had no relevant effect on oral cancer risk (OR: 1.01, F = 79%, P = 0.88). Tea intake (OR: 0.78, F = 79%, P < 0.001) and consumption of ≥6 cups/day (OR: 0.79, F = 80%, P = 0.02) did have a significant protective effect on oral cancer. Conclusions: Only the consumption of tea had a protective effect on oral cancer.

Keywords: Coffee, mouth neoplasms, risk factors, tea

Introduction

Oral cancer is a global public health problem with an important incidence, and its mortality rate has not improved significantly in recent decades. In 2018, these mouth neoplasms were responsible for 354,864 new cases (2.0% of all cancers) and 177,384 deaths (1.9%).[1] Its etiology is multifactorial with classic factors such as tobacco and/or alcohol consumption in addition to human papillomavirus infection or dietary factors.[2] Coffee and tea, after water, are probably the most consumed beverages in the world. Several studies[3,4] analyze the possible effect of the consumption of these beverages on the risk of oropharyngeal cancer with contradictory results, some point out that it is a risk factor, others that it is a protective factor. However, there are differences between oral cancer and pharyngeal cancer, so the effect of these drinks on oral cancer could be different. The aim of this study was to assess the possible effect of coffee and/or tea consumption on oral cancer.

Methods

A PubMed search of case–control studies about the consumption of coffee and/or tea on oral cancer patients was conducted through December 2018. Search strategies included terms from the Medical Subjects Headings (MeSH) and free-text terms such as “mouth neoplasms” [MeSH Terms], “oral cancer” [All Fields] AND “coffee” [MeSH Terms], “coffee” [All Fields] OR “tea” [MeSH Terms], “tea” [All Fields]. After this initial search, 102 articles were found between 1990 and 2017.

Solely articles with full-text availability were considered (n = 79). The exclusion criteria were: (a) studies on cancers that did not exclusively affect the oral cavity (n = 29) and (b) studies with non-useable data (n = 32). Finally, 18 studies were included in this meta-analysis [Figure 1].

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Statistical analysis

Meta-analysis was implemented using the RevMan 5.3 program (The Cochrane Collaboration, Oxford, UK). For dichotomous outcomes, the odds ratio (OR) was used with the Mantel-Haenszel Chi-square formula with 95% confidence intervals (95% CIs). Heterogeneity was established considering the values of P and the Higgins statistic (I²). The random-effects model was applied in cases of high heterogeneity. Pearson’s Chi-square test was also used when required. The minimum level of significance was set at P < 0.05.

Results

The main descriptive characteristics of the 18 articles included in the meta-analysis are shown in Table 1.[5-22]

Thirteen studies[5-17] analyzed coffee consumption in patients with oral cancer and in controls without the disease [Figure 2a]. A higher percentage of patients with oral cancer than controls who consumed coffee was found. Nevertheless, the coffee consumption was not a risk factor for oral cancer, and no statistically significant relationship was observed (OR = 0.98, 95% CI: 0.88–1.09, P = 0.68).

Regarding the consumption of decaffeinated coffee [Figure 2b], three studies[7,9,17] also found no statistically significant influence of the consumption of this type of coffee on oral cancer risk (OR = 0.89, 95% CI: 0.58–1.38, P = 0.61).

Figure 2c presents the 15 studies[6-9,11-14,16-22] that considered the possible influence of tea intake on oral cancer risk. About 52.8% of the controls and 39.8% of the patients with oral cancer reported tea ingestion. The consumption of this drink had a protective effect against oral cancer with statistically significant differences (OR = 0.78, 95% CI: 0.67–0.90, P < 0.001).

Table 2 shows the comparison of coffee or tea intake in patients with oral cancer and in controls without the disease. The coffee intake was slightly higher in patients with oral cancer (86.9%) than in controls (86.1%) with no statistically significant association (P = 0.14). In the case of tea consumption, there was a higher percentage of controls (40.5%) than in patients with oral cancer (38.1%) who ingested tea. After the statistical analysis, significant differences were observed (P < 0.01).

Twelve studies[5,7-17] evaluated high coffee intake (≥6 cups/day) in patients with oral cancer and in controls without the disease [Figure 3a]. A lower percentage of patients with oral cancer than controls with high coffee consumption was observed. After statistical analysis, no significant differences were found (OR = 1.01, 95% CI: 0.84–1.23, P = 0.88).

With regard to high tea intake [Figure 3b], 13 studies[5,9,11-14,16,22] assessed the intake of ≥6 cups of tea/day in patients with oral cancer and in controls. There was a lower percentage of patients with oral cancer (22.7%) than controls (29.1%) with this high tea consumption, with a statistically significant association (OR = 0.79, 95% CI: 0.64–0.97, P = 0.02).

The comparison between the quantity (low/high) of coffee or tea consumed by patients with oral cancer and by controls without the disease is shown in Table 3. Controls had higher intakes of both coffee (57.4%) and tea (48.6%) compared to oral cancer patients (34.5% and 36.4%, respectively). After the analysis, highly significant differences were found in both comparisons (P < 0.001).

Discussion

In this meta-analysis on the effects of coffee and/or tea consumption on oral cancer risk, data from 18 studies have been included.

Thirteen studies[5,17] analyzed the coffee consumption in patients with oral cancer and in controls without the disease, five of them[10,13,14,16,17] with a higher number of oral cancer patients who consumed coffee and, another eight[7,10,13,15-17] with a greater number of controls. Coffee consumption had no significant protective effect on the risk of oral cancer (OR = 0.98, 95% CI: 0.88–1.09, P = 0.68). Nevertheless, the results of Galeone et al.[9] support the hypothesis of an inverse association between coffee consumption and the risk of oral and pharyngeal cancer, although other relevant risk factors for these cancers, such as tobacco and/or alcohol consumption, should be considered. This possible protective effect of coffee consumption on cancer could also be justified in that coffee beans contain several phenolic compounds with antioxidant properties, such as caffeic acid and chlorogenic acid, that would exert an anti-cancer activity.[15]

About the decaffeinated coffee consumption, three studies[7,9,17] found no statistically significant influence of...
the consumption of this type of coffee on the risk of oral cancer ($P = 0.61$). The consumption of decaffeinated coffee did not increase oral cancer risk. However, in these studies, data were scarce with low prevalences, and low amounts of decaffeinated coffee consumed. Nonalcoholic beverages such as coffee or tea could contribute to the mechanical cleaning of potential carcinogens from the oral cavity, providing greater protection against oral cancer.$^{[9]}$

Regarding high coffee consumption ($\geq 6$ cups daily), in the present study, no statistically significant association was found between high coffee intake and oral cancer risk (OR = 1.01, 95% CI: 0.84–1.23, $P = 0.88$). Twelve studies$^{[5,7‑17]}$ evaluated high coffee consumption with respect to oral cancer, finding apparently contradictory results. One study$^{[12]}$ indicated that it was a protective factor and another two$^{[9,14]}$ that it was a risk factor. The consumption of three or more cups of coffee/day had a significant inverse association with oral cancer, although this association could be modified by the influence of other important factors such as smoking and alcohol consumption. It is possible that the increase in coffee intake decreases the intake of alcohol and thus reduces the risk of oral cancer.$^{[12]}$ Conversely, other studies established a direct relationship between the amount of coffee consumed and the risk of oral cancer in the univariate analysis. However, when in the multivariate analysis, other factors were considered, such as the consumption of tobacco and/or alcohol or vegetables, the high intake of coffee ceased to be a risk factor.$^{[9]}$

In the present meta-analysis, the ingestion of tea showed a significant protective effect against oral cancer (OR = 0.78, 95% CI: 0.67–0.90, $P < 0.001$). Of the 15$^{[6‑9,11‑14,16‑22]}$ studies that examined the possible role of tea consumption in oral cancer, six of them$^{[4,17‑19,21]}$ observed a significant protective effect. Most studies coincided in pointing out a protective effect of tea consumption. However, the intake of other beverages and the dietary habits of the population...
Table 1: Descriptive characteristics of included studies

| First author | Years | Country | Study populations | n (gender: Male/female) | Beverage assessed | Remarks |
|--------------|-------|---------|-------------------|------------------------|------------------|---------|
| Biazevic[5]  | 2011  | Brazil  | 115 OC (93 male/22 female) | 240 controls (NA/NA) | Coffee           | Cumulative coffee consumption during lifetime had a significant protective effect against OC |
| Bundgaard[6] | 1995  | Denmark | 161 OC (97 male/64 female) | 400 controls (250 male/150 female) | coffee, tea | Coffee and tea intake had no significant influence on oral cancer risk |
| Franceschi[7] | 1992  | Italy   | 206 OC (206 male/0 female) | 726 controls (726 male/0 female) | Coffee, tea | Coffee and tea consumption had a significant protective effect against OC |
| Franco[8]    | 1989  | Brazil  | 232 OC (201 males/31 females) | 464 controls (NA/NA) | Coffee, tea | Coffee and tea intake had no significant influence on oral cancer risk |
| Galeone[9]   | 2010  | Italy   | 1191 OC (905 males/286 females) | 9028 controls (6356 males/2772 females) | Coffee, tea | Coffee, but not decaffeinated coffee, had a significant protective effect against OC. Tea intake did not have any influence |
| La Vecchia[10] | 1989  | Japan   | 50 OC (43 males/7 females) | 1944 controls (1334 males/610 females) | Coffee | Coffee intake had no influence on oral cancer risk |
| Mashberg[11] | 1993  | USA     | 359 OC (NA/NA) | 2280 controls (NA/NA) | Coffee, tea | Coffee and tea intake had no significant influence on oral cancer risk |
| Oze[12]      | 2014  | Japan   | 503 OC (406 male/97 female) | 1544 controls (1245 males/299 females) | Coffee, tea | Coffee, but not tea consumption, had a protective effect on oral cancer |
| Pintos[13]   | 1994  | Brazil  | 169 OC (153 males/16 females) | 338 controls (307 males/31 females) | Coffee, tea | Coffee and tea intake had no significant influence on oral cancer risk |
| Radoi[14]    | 2013  | France  | 689 OC (556 males/133 females) | 3481 controls (2720 males/761 females) | Coffee, tea | Tea intake and/or high coffee consumption had a significant protective effect on oral cancer |
| Rodriguez[15] | 2004  | Italy   | 137 OC (113 males/24 females) | 298 controls (226 male/72 female) | Coffee | High coffee consumption had a significant protective effect on oral cancer |
| Takezaki[16] | 1996  | Japan   | 137 OC (113 males/24 females) | 36527 controls (9858 males/26,669 females) | Coffee, tea | Coffee and tea consumption had no significant influence on oral cancer risk |
| Tavani[17]   | 2003  | Italy   | 749 OC (634 male/115 female) | 1772 controls (1252 males/520 females) | Coffee, tea | Coffee and tea consumption had no significant influence on oral cancer risk |
| Chen[18]     | 2016  | China   | 207 OC (0 male/207 females) | 480 controls (0 male/480 females) | Tea | Tea intake had a significant protective effect on oral cancer |
| Chen[19]     | 2017  | China   | 421 OC (105 males/316 females) | 1398 controls (402 males/996 females) | Tea | Tea consumption had a significant protective effect on oral cancer |
| Fu[20]       | 2013  | China   | 723 OC (485 males/238 females) | 857 controls (576 males/281 females) | Tea | Green tea intake, only in men had a significant protective effect on oral cancer |
| Toporcov[21] | 2004  | Brazil  | 70 OC (50 male/20 female) | 70 controls (50 males/20 females) | Tea | Tea consumption had a significant protective effect on oral cancer |
| Zheng[22]    | 1993  | China   | 404 OC (NA/NA) | 404 controls (NA/NA) | Tea | Tea intake had no significant influence of oral cancer risk |

n: Number of participants, OC: Oral cancer patients, NA: Data not available

Table 2: Coffee and tea intake in oral cancer patients and controls without the disease

| Coffee intake | Oral cancer, n (%) | Controls, n (%) | Tea intake | Oral cancer, n (%) | Controls, n (%) |
|---------------|--------------------|-----------------|------------|--------------------|-----------------|
| Yes           | 4202 (86.9)        | 13,758 (86.1)   | Yes        | 1974 (38.1)        | 6269 (40.5)     |
| No/occasional | 633 (13.1)         | 2225 (13.9)     | No/occasional | 3213 (61.9)        | 9206 (59.5)     |
| Total         | 4835 (100)         | 15,983 (100)    | Total      | 5187 (100)         | 15,475 (100)    |

χ², P = 2.08, 0.14
χ², P = 9.65, <0.01*

*Statistically significant. n: Number of participants

must be taken into account to establish the true effect of the consumption of this beverage on the risk of oral cancer.[21] Thirteen studies[8,9,11-14,16-22] investigated high tea consumption (≥6 cups daily) in patients with oral cancer.
Table 3: Quantity of coffee/tea consumed by oral cancer patients and controls without the disease

| Quantity of coffee consumed | Oral cancer, n (%) | Controls, n (%) | Quantity of tea consumed | Oral cancer, n (%) | Controls, n (%) |
|-----------------------------|--------------------|----------------|--------------------------|--------------------|----------------|
| Low                         | 2680 (65.5)        | 12,492 (42.6)  | Low                      | 2994 (63.6)        | 11,077 (51.4)  |
| High                        | 1411 (34.5)        | 16,839 (57.4) | High                     | 1714 (36.4)        | 10,454 (48.6)  |
| Total                       | 4091 (100)         | 29,331 (100)  | Total                    | 4708 (100)         | 21,531 (100)   |

χ², P 759.94, <0.001*  
χ², P 228.73, <0.001*

*Statistically significant. n: Number of participants

and in controls without the disease. In this study, the high intake of tea had a significant protective effect against oral cancer (OR = 0.79, 95% CI: 0.64–0.97, P = 0.02). Similarly, four studies observed a significant protective effect of high tea consumption on oral cancer.[17,19–21] The consumption of green tea reduced the risk of cancer among women who drank more than 10 cups a day, pointing to a possible influence of gender. It is likely that tea intake stimulates the production of estrogens and exerts a protective effect on women. In addition, tea contains polyphenols, catechins, and other antioxidant compounds that could develop an anticarcinogenic activity through different mechanisms.[19]

In contrast, another study observed a greater reduction in the risk of oral cancer in men, with a high intake of green tea, although more smokers.[20]

This study presents several limitations. When searching in PubMed database, almost exclusively, English-language studies were included, representing a language restriction and the possibility of language and publication bias. Another possible limitation is the large differences in the sample sizes existing in the studies considered in this meta-analysis. Studies with small sample sizes tend to have low statistical power and may provoke erroneous interpretations. Furthermore, other interesting variables, such as the different types of coffee/tea consumed, or the drink temperature could not be properly analyzed.

New studies are needed to determine the true effect of the consumption of these beverages on the risk of cancer and, specifically, on oral cancer.

The results of this meta-analysis should be interpreted with caution due to the high heterogeneity of some of the studies included. These differences between studies may be conditioned by the study design, the methods to
gather information, the statistical analysis applied, the characteristics of the study populations, or the duration of the studies.

Conclusions

In the present meta-analysis, tea consumption (OR: 0.78, \( P < 0.001 \)) but not that of coffee (\( P = 0.68 \)) or that of decaffeinated coffee (\( P = 0.61 \)), had a significant protective effect on oral cancer. On the other hand, high consumption (≥6 cups daily) of coffee had no significant effect (\( P = 0.88 \)), while high tea consumption had a protective effect (OR: 0.79, \( P = 0.02 \)) for oral cancer.

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Conflicts of interest

There are no conflicts of interest.

References

1. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2018;68:394-424.

2. Kumar M, Nanavati R, Modi TG, Dobariya C. Oral cancer: Etiology and risk factors: A review. J Cancer Res Ther 2016;12:458-63.

3. Miranda J, Monteiro L, Albuquerque R, Pacheco JJ, Khan Z, Lopez-Lopez J, et al. Coffee is protective against oral and pharyngeal cancer: A systematic review and meta-analysis. Med Oral Patol Oral Cir Bucal 2017;22:e554-61.

4. Li YM, Peng J, Li LZ. Coffee consumption associated with reduced risk of oral cancer: A meta-analysis. Oral Surg Oral Med Oral Pathol Oral Radiol 2016;121:381-90.

5. Biazevic MG, Toporcov TN, Antunes JL, Rotundo LD, Brasiliero RS, de Carvalho MB, et al. Cumulative coffee consumption and reduced risk of oral and oropharyngeal cancer. Nutr Cancer 2011;63:350-6.

6. Bundgaard T, Wildt J, Frydenberg M, Elbrod O, Nielsen JE. Case-control study of squamous cell cancer of the oral cavity in Denmark. Cancer Causes Control 1995;6:57-67.

7. Franceschi S, Barra S, La Vecchia C, Bidoli E, Negri E, Talamini R. Risk factors for cancer of the tongue and the mouth. A case-control study from Northern Italy. Cancer 1992;70:2227-33.

8. Franco EL, Kowalski LP, Oliveira BV, Curado MP, Pereira RN, Silva ME, et al. Risk factors for oral cancer in Brazil: A case-control study. Int J Cancer 1989;43:992-1000.

9. Galeone C, Tavani A, Pelucchi C, Turati F, Winn DM, Levi F, et al. Coffee and tea intake and risk of head and neck cancer: Pooled analysis in the international head and neck cancer epidemiology consortium. Cancer Epidemiol Biomarkers Prev 2010;19:1723-36.

10. La Vecchia C, Ferraroni M, Negri E, D’Avanzo B, Decarli A, Levi F. Coffee consumption and digestive tract cancers. Cancer Res 1989;49:1049-51.

11. Mashberg A, Boffetta P, Winkelman R, Garfinkel L. Tobacco smoking, alcohol drinking, and cancer of the oral cavity and oropharynx among U.S. Veterans. Cancer 1993;72:1369-75.

12. Oze I, Matsuo K, Kawakita D, Hosono S, Ito H, Watanabe M, et al. Coffee and green tea consumption is associated with upper aerodigestive tract cancer in Japan. Int J Cancer 2014;135:391-400.

13. Pintos J, Franco EL, Oliveira BV, Kowalski LP, Curado MP, Dewar R. Maté, coffee, and tea consumption and risk of cancers of the upper aerodigestive tract in southern Brazil. Epidemiology 1994;5:583-90.

14. Randi L, Paget-Bailly S, Menivelle G, Cyr D, Schmaus A, Carton M, et al. Tea and coffee consumption and risk of oral cavity cancer: Results of a large population-based case-control study, the ICARE study. Cancer Epidemiol 2013;37:284-9.

15. Rodriguez T, Altieri A, Chatenoud L, Gallus S, Bosetti C, Negri E, et al. Risk factors for oral and pharyngeal cancer in young adults. Oral Oncol 2004;40:207-13.

16. Takezaki T, Hirose K, Inoue M, Hamajima N, Kuroishi T, Nakamura S, et al. Tobacco, alcohol and dietary factors associated with the risk of oral cancer among Japanese. Jpn J Cancer Res 1996;87:555-62.

17. Tavani A, Bertuzzi M, Talamini R, Gallus S, Parpinel M, Franceschi S, et al. Coffee and tea intake and risk of oral, pharyngeal and esophageal cancer. Oral Oncol 2003;39:695-700.

18. Chen F, He B, Hu Z, Huang J, Liu F, Yan L, et al. Passive smoking and cooking oil fumes (COF) may modify the association between tea consumption and oral cancer in Chinese women. J Cancer Res Clin Oncol 2016;142:995-1001.

19. Chen F, Yan L, Lin L, Liu F, Qiu Y, Liu F, et al. Independent and joint effects of tea and milk consumption on oral cancer among non-smokers and non-drinkers: A case-control study in China. Oncotarget 2017;8:50091-7.

20. Fu JY, Gao J, Zhang ZY, Zheng JW, Luo JF, Zhong LP, et al. Tea consumption and the risk of oral cancer incidence: A case-control study from China. Oral Oncol 2013;49:918-22.

21. Toporcov TN, Antunes JL, Tavares MR. Fat food habitual intake and risk of oral cancer. Oral Oncol 2004;40:925-31.

22. Zheng T, Boyle P, Willett WC, Hu H, Dan J, Evstifeeva TV, et al. A case-control study of oral cancer in Beijing, people’s republic of China. Associations with nutrient intakes, foods and food groups. Eur J Cancer B Oral Oncol 1993;29B:45-55.