



Alcohol consumption and the risk of cancer in Brazil: A study involving 203,506 cancer patients



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ABSTRACT

This study aims to analyze the association between alcohol consumption and the risk of developing the most common types of cancer in the Brazilian population. It is a case-control study in which the most common types of cancer were considered as cases and non-melanoma skin cancers as controls. Data were routinely obtained by hospital-based cancer registrars. Individuals between 18 and 100 years old, diagnosed between January 1, 2000 and December 31, 2009, with information regarding alcohol consumption, were included. The odds ratio (OR) for each type of cancer was calculated, adjusting for confounding variables. The etiologic fraction (EF) was calculated in cases with statistically significant results. The study included 203,506 individuals (110,550 women and 92,956 men), with an average age of 59 years. A statistically significant association was found between alcohol consumption and increased risk of cancers of the respiratory and digestive systems, prostate, and female breast. The association between alcohol consumption and cancers of the urinary tract, male genital organs, and other neoplasias was not statistically significant. Consumption of alcoholic beverages increased the risk of developing cancer of the nasal cavity, pyriform sinus, oral cavity, oropharynx, nasopharynx, larynx, hypopharynx, lung, esophagus, stomach, liver, pancreas, breast, prostate, colon and rectum, and anus and anal canal.

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Introduction

Cancer is considered an important public health problem, both in developing and developed countries. By the year 2030, 20.3 million new cancer cases and 13.2 million deaths related to the disease are expected (Bray, Jemal, Grey, Ferlay, & Forman, 2012). According to the World Health Organization (WHO, 2005), 40% of all deaths caused by cancer could be avoided.

About a third of the deaths from cancer are due to behavioral and nutritional risk factors such as lack of physical activity, high body mass index, low intake of fruits and vegetables, smoking, and alcohol consumption (WHO, 2015). Exposure to more than one factor increases the risk of developing cancer. An example is the action of alcohol and tobacco together, which increases the risk of oral, pharynx, and larynx cancers (WCRF/AICR, 2007).

In terms of mortality related to alcohol consumption, almost half of the global burden is associated with acute alcoholic intoxication, followed by malignant neoplasms (Rehm et al., 2004). According to

the International Agency for Research on Cancer (IARC, 2010, 2012), there is sufficient evidence that the consumption of alcohol is a potential carcinogen, as it has a causal relationship with oral cavity cancer and cancer of the pharynx, larynx, esophagus, liver, colon and rectum, and breast. Bagnardi, Blangiardo, La Vecchia, and Corrao (2001) reported that drinking alcohol increases the risk of cancer of the oral cavity, pharynx, larynx, esophagus, stomach, colon, rectum, liver, breast, and ovaries. They also showed that there was minimal risk related to lung cancer and prostate cancer. Boffetta and Hashibe (2006) reviewed multiple studies that provided evidence of consistent positive associations between alcohol and multiple cancers such as mouth, pharynx, esophagus, liver, colon, rectum, and breast.

In Brazil, studies confirming the association between alcohol consumption and the development of cancer are scarce; most of the available data refer to studies conducted in North America, Europe, and Asia (Gupta, Wang, Holly, & Bracci, 2010; Kawai et al., 2011; Park et al., 2010). In addition, results obtained in other countries cannot always be applied to the Brazilian population, which has its own ethnic, behavioral, and genetic characteristics. Furthermore, Lachenmeier et al. (2010) stated that there are differences in the behavior of Brazilian and European populations related to alcoholic

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beverage preferences as well as the concentration of the beverage components, such as ethyl carbamate. Similarly, Nóbrega et al. (2013) reported that when compared to other countries, Brazilian spirits have lower concentrations of methanol, ethyl acetate, n-propanol, and isobutanol. At the same time, we are unaware of the existence of robust studies in Brazil.

The aim of this study was to analyze the association between alcohol consumption and the risk of developing the main types of cancer in the Brazilian population.

Method

This was a case-control study. Data collection was performed using the Integrator System of Cancer Hospital Registries (CHR), a web-based system that enables the consolidation and dissemination of data available from the CHR. The CHR covers about 90% of the Brazilian public health system, comprising hospitals providing oncological assistance located in the Federal District and 25 of Brazil's 27 states. The CHR is being gradually implemented over time in the country and it is difficult to estimate the completeness of data coverage (INCA, 2010).

Individuals with information gathered regarding the consumption of alcoholic beverages, diagnosed between January 1, 2000 and December 31, 2009, and aged between 18 and 100 years, were included. The most frequent types of cancer and those with a possible association with alcohol, shown in a recent systematic literature review (Menezes, Bergmann, & Thuler, 2013), were investigated: oral cavity (C00–C08), oropharynx (C10), nasopharynx (C11), pyriform sinus (C12), hypopharynx (C13), esophagus (C15), stomach (C16), colon and rectum (C18–C20), anus and anal canal (C21), liver (C22), gall bladder (C23), other parts of the biliary system (C24), pancreas (C25), nasal cavity, middle ear, and sinuses (C30–C31), larynx (C32), bronchus and lungs (C33–C34), kidney (C64), bladder (C67), central nervous system (C70–C72), thyroid (C73), female breast (C50), vulva (C51), vagina (C52), cervix (C53), endometrium (C54.1), ovary (C56), penis (C60), prostate (C61), testis (C62), and myeloid leukemia (C42), comprising the morphologies 9840, 9860, 9861, 9863, 9871–9874, 9876, 9895–9897, 9910, and 9930 (WHO, 2000). Cases registered as non-melanoma skin cancer (C44) were used as the control group. This group was selected for comparison due to the lack of association between alcoholic beverage consumption and this type of cancer (IARC, 2010). Patients with erroneous data on alcohol consumption ($n = 213$) and with no gender information ($n = 30$) were excluded.

The main exposure variable was alcohol consumption, collected by the cancer registrars from written comments in the medical charts and categorized as current alcohol consumption (more than 3 times per week, independent of amount consumed) and non-consumer. We also analyzed the following variables: age (≤ 24 , 25–39, 40–49, 60–74, and ≥ 75 years), gender (male and female), race [(white, black, mulatto, indigenous, and Asian Brazilians), as adopted for classification by the Instituto Brasileiro de Geografia e Estatística – IBGE (INCA, 2010)], education (illiterate, ≤ 8 years education, and > 8 years education), marital status (with partner, without partner), smoking (smokers and non-smokers), region of residence (North, North-East, Midwest, South-East and South) and year of diagnosis (2000–2004 and 2005–2009).

A descriptive analysis was performed by means of absolute and relative frequency. The odds ratio (OR) for each type of cancer, stratified for males and females, was calculated, assuming a confidence interval of 95%. In order to control for potential confounding variables, adjusted ORs (aORs) by age, sex, race, education, marital status, smoking, region of residence, and year of diagnosis were calculated. The OR values that do not include the null value (1.0) were classified as reduced risk (OR lower than 1.0), low risk (OR

Table 1

Topography of cancers by gender.

Location of tumor	ICD-O-3	Male	Female	Total
Organs of the respiratory system				
Nasal cavity, middle ear, and sinuses	C30–C31	474	286	760
Pyriform sinus	C12	609	45	654
Larynx	C32	5865	839	6704
Bronchi and lungs	C33–C34	8012	3647	11,659
Organs of the digestive system				
Oral cavity	C00–C08	8318	2714	11,032
Oropharynx	C10	2319	400	2719
Nasopharynx	C11	701	292	993
Hypopharynx	C13	1332	149	1481
Esophagus	C15	6341	1838	8179
Stomach	C16	6061	3116	9177
Pancreas	C25	811	700	1511
Liver	C22	701	388	1089
Gall bladder	C23	109	374	483
Other parts of the biliary system	C24	179	173	352
Colon and rectum	C18–C20	7005	7265	14,270
Anus and anal canal	C21	333	964	1297
Organs of the urinary system				
Kidney	C64	1150	814	1964
Bladder	C67	2670	862	3532
Other neoplasms				
Central nervous system	C70–C72	1222	968	2190
Thyroid	C73	706	3317	4023
Myeloid leukemia	C42	1209	987	2196
Male genital organs				
Penis	C60	897	0	897
Prostate	C61	21,228	0	21,228
Testis	C62	1041	0	1041
Breast and female genital organs				
Breast	C50	0	39,472	39,472
Vulva	C51	0	907	907
Vagina	C52	0	254	254
Cervix uteri	C53	0	22,711	22,711
Endometrium	C54.1	0	2551	2551
Ovary	C56	0	3340	3340
Controls: skin	C44	13,663	11,177	24,840
Total	–	92,956	110,550	203,506

1.1–1.5), moderate risk (OR higher than 1.5–2.5), high risk (OR higher than 2.5–3.9), and very high risk (OR higher than or equal to 4) (Rosenthal, 1996). Statistically significant differences were defined as $p < 0.05$.

The etiologic fraction (EF) was calculated for results where the aOR was statistically significant. Assuming that the risk of disease in the population is low and that the OR is similar to the relative risk (RR), the following equation was used: $P_c = (aOR - 1)/aOR$, where P_c is the proportion of exposed cases and aOR is the adjusted odds ratio (Nurminen & Karjalainen, 2001). PASW Statistics software, version 18.0 was used for data analysis.

For better presentation, the results were grouped into organs of the respiratory system, organs of the digestive system, organs of the urinary system, male genital organs, female genital organs, and other organs. This study was performed in accordance with the ethical principles for human investigations and was approved by the Brazilian National Cancer Institute Ethics Committee (128/11).

Results

The study included 203,506 cases of cancer in the period between 2000 and 2009. The three most frequent types of cancer in men were prostate (21,228), oral cavity (8318), and bronchi and lungs (8012), while for women they were breast cancer (39,472), cervical cancer (22,711), and colon and rectum (7265) (Table 1).

The sociodemographic characteristics of the studied population are presented in Table 2. The frequency of individuals who

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