Original Article

Dietary Habits: A Risk or Protective Factor for Cancer of the Mouth and Oropharynx in Goias, Brazil?

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Abstract

In developed countries, oral cancer is the eightieth most common cancer type, whereas in the developing world it is the fourth most common type of the disease. Known risk factors for oral cancer are smoking, alcohol consumption, poor oral hygiene, poorly-fitting dentures. This study analyzed sociodemographic and dietary factors as risk factors for cancer of the mouth and oropharynx. **Patients and Methods:** This case-control study was carried out from November 1998 to June 2003. The cases were patients with a diagnosis of squamous cell carcinoma of the mouth and oropharynx at the *Araujo Jorge Hospital* in Goiania, Goias, Brazil. Controls were selected in two public general hospitals of Goiania with no oncologic departments. **Results:** The study consisted of 200 cases (41.8%) and 279 controls (58.2%). Multivariate analysis, adjusted for smoking, alcohol consumption and place of residence, showed that fish, fresh tomatoes, citric fruit, apples and pears consumption was a protective factor, while cakes and desserts remain as independent risk factors. **Conclusions:** Dietary habits are important in the prevention of oral and oropharyngeal cancer. Healthy dietary habits should be stimulated through educational campaigns, the objective of which should also be to combat alcohol and tobacco consumption.

Keywords: Dietary Habits. Cancer. Mouth. Oropharynx.

Introduction

According to the World Health Organization, the estimated annual number of new cases of cancer will increase from 10 million in 2000 to 15 million in 2020, and 60% of new cases will occur in less developed regions in countries with less than 5% of resources required for cancer control.[1] Analyses of neoplasias in developed and developing countries point out significant differences regarding the occurrence of oral cancer. In developed countries, cancer of the mouth and oropharynx has little significance, reaching only 3% of all cancer cases and taking up the eightieth position of the most common types of cancer; however, in developing countries, oral cancer is the fourth most common type of cancer, reaching 8% of all cases.[2,3]

The world's geographic distribution of oral cavity and oropharyngeal cancer is heterogeneous, varying

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according to the degree of industrial development in the different regions; the highest incidence rate is in France 26.3/100.000, for males, followed by Pakistan (22.8/100.000) and Brasil, Sao Paulo, 18.1/100.000; in Goiania the rate reaches 12.1/100.000.[4]

Oral and oropharynx cancer is more common in males (75% of cases), and in individuals over 50 years of age, being squamous cell carcinoma the most common histological type.[1-6]

In Brazil, it is expected in 2008 the occurrence of 14,160 new cases in males and females, making this type of cancer the fifth most common neoplasia in the country. In Goiás, as of 2008, 330 new cases are estimated to occur, 110 of which will occur in the state capital.[7]

Studying risk factors for malignant neoplasias is today a relevant tool that may be used to implement policies for the promotion of health and the prevention of the disease. Known risk factors for oral cavity and oropharyngeal cancer are smoking and alcohol consumption, as well as life habits and some types of diet.[7]

Etiopathogenic studies suggest that dietary habits may have a protective role with respect to oral cancer. Some of the chemical components present in food may block tumor genesis at its earliest stages, for example, the bioactive components of fruit and vegetables, which induce the detoxifying effect of enzymes.[8] Other components appear to act on carcinogenesis[9,10] as a consequence of the reduction in the generation of reactive oxygen species that in turn may cause damage to DNA.[8] Winn et al.[11] calculated that fruits-rich diets promote a reduction of 20%-80% in the risk of oral cancer.

A case-control, hospital-based study carried out in Brazil, as part of a IARC multicenter Latin American study, reported that the traditional Brazilian diet of rice, beans and a moderate serving of meat may protect against oral cancer irrespective of other recognized risk factors such as alcohol or tobacco consumption.[12]

Goiania population is concentrated in urban areas (87.8%),[13] and thus exposed to smoking and alcohol consumption and to a fiber-poor diet, all of which are risk factors for oral cavity and oropharyngeal cancer.[11]

In 1998, the Goiania population-based cancer registry was invited by the International Agency for Research on Cancer (IARC) to participate in a multicenter study aiming mainly to analyze the risks for cancer of the oral cavity and oropharynx. The present study is part of this case-control study which analyzes Goiania population's socio-demographic factors and dietary habits as risk factors for cancer of the mouth and oropharynx.

Patients and Methods

From November 1998 to June 2003, this study enrolled patients over 15 years of age of both sexes, who had been living in the state of Goias for at least six months.

Assuming an α of 0.05, a power of 0.80 and an estimated prevalence of exposure to risk of 10% in the controls, the sample size required to detect an odds ratio (OR) of at least 2.3 was calculated at 207 cases and 207 controls. The final sample consisted of 200 cases and 279 controls.

Cases were selected at the Department of Head and Neck Surgery of the Araujo Jorge Hospital in Goiania, Goias, Brazil, and were classified according to the topographical location of the tumor as proposed in the International Classification of Diseases and Related Health Problems – 10th Revision (ICD-10) 14, corresponding to codes C01 and C02 (tongue), C03 (gum), C04 (floor of mouth), C05 (palate), C06 (other and unspecified parts of the mouth), C09 (tonsil), C10 (oropharynx) and C14 (other and ill-defined sites in the lips, oral cavity and pharynx).

The control group was composed of patients from two Public State hospitals in Goiania not specialized in oncology. No patient in the control group had a previous clinical history of oral or oropharyngeal cancer or suspected diseases associated with risk factors known to cause oral and oropharyngeal cancer. To guarantee the comparability of dietary habits between cases and controls, the controls were paired according to sex and age-group with patients in the study group and region of origin. Patients with confirmed diagnosis and those who refused to participate in the interview were not included in the study. To describe the study population, the following variables were taken into consideration: age, gender, race, smoking, alcohol consumption, education level, diet.

The chi-squared test and Student's t-test were used, as applicable, in the comparative analysis of variables. Afterwards, a univariate analysis was carried out to evaluate the association between variables and cancer of the oral cavity or oropharynx; and then, an unconditional multiple logistic regression model was used to analyze predictive factors for the occurrence of this type of cancer, while simultaneously controlling the variables smoking, alcohol consumption and place of residence.[15] The SPSS statistical software program, version 15.0, was used for the statistical analysis.

This project was approved by the Ethical Review Committee of the Araujo Jorge Hospital on June 30, 1998. All patients in this study gave their signed free and informed consent to participate.

Results

Two hundred patients with squamous cell carcinoma of the mouth or oropharynx (41.8%) and 279 controls (58.2%) were selected for this study. Analysis of staging, carried out according to the Tumor, Nodes and Metastases – TNM classification,[15] showed that most cases were in clinical stage IV: T4 = 87 (43.5%), N0 = 109 (54.5%) and M0 = 198 (99%). Analysis of the reason for hospitalization of the controls showed that 74 (26.7%) were hospitalized due to external injuries, 64 (24.7%) due to diseases of the digestive tract and 51 (18.3%) due to circulatory diseases.

Table 1 shows the sociodemographic characteristics of the patients. No statistical significant differences were found between cases and controls with respect to sex, age or marital status. Comparing risks by origin — urban or rural —, patients living in urban areas had a higher risk (OR=3.87 95% CI 2.61–5.63 p<0.001).

Regarding educational level, patients with lower education levels presented a higher risk for mouth and oropharynx cancer (OR=1.58 95% CI 1.04–2.39 p=0.02) compared to the group of higher educational level.

Cigarette smoking was most frequent in patients than in controls (60.9% vs. 39.4% p <0001) with high risk (OR=11.3 95% CI 5.5- 23.1), and alcohol consumption was more frequent in controls (47.2% vs. 52.8%, p = 0001). Univariate analysis showed alcohol–consuming patients to have a higher risk of developing oral cancer than controls (OR=2.68 95% CI 1.51–4.73). However, the risk rate does not change for the group that stopped drinking. (Table 2)

Univariate analyses of dietary habits showed the consumption of dairies, fish, vegetables, raw vegetables and salads, citric fruits, apples and pears to be a protection factor, (OR=0.36 95% CI 0.20–0.64 p<0.01), and the consumption of cakes and desserts as being statistically

Table 1 – Number and percentage of patients according to sociodemographic variables

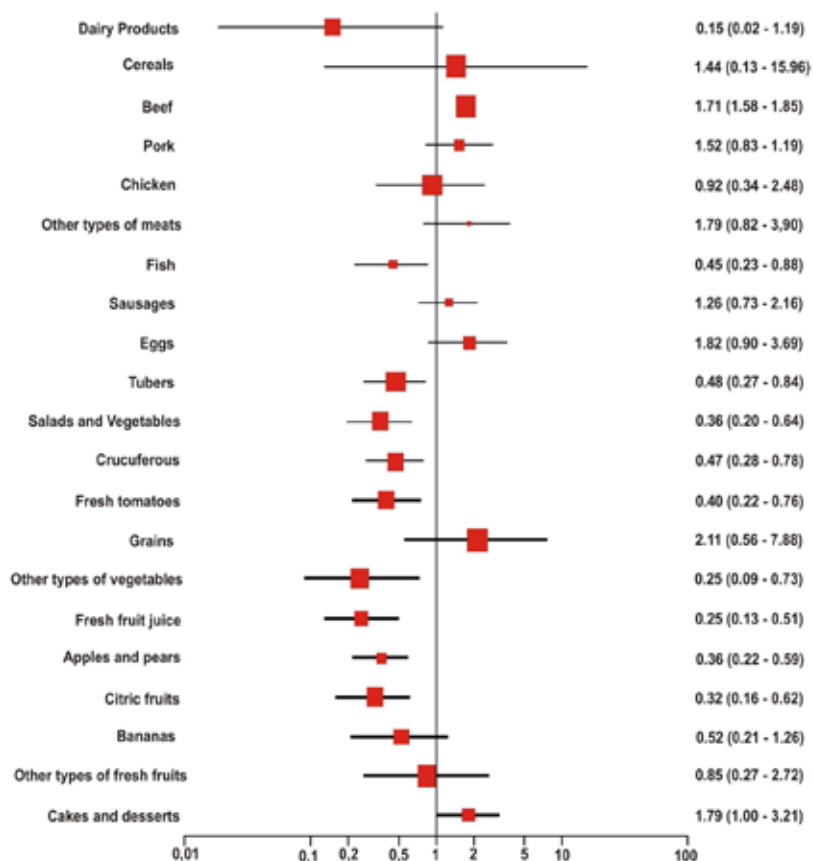| Variables		Study Group		Control Group		p	OR (95% CI)
		N	%	N	%		
Sex (gender)							
	Male	157	41.3	223	58.7	0.703	1
	Female	43	43.4	56	56.6		0.917 (0.587-1.433)
Age							
	<40 years	11	31.4	24	68.6	0.198	1
	> 40 years	189	42.6	255	57.4		0.618 (0.296-1.294)
Marital Status							
	Married	120	39.5	184	60.5		1
	Divorced	48	46.6	55	53.4	0.204	0.747 (0.476-1.172)
	Widowed	23	45.1	28	54.9	0.449	0.794 (0.437-1.443)
	Not responded	9	42.9	12	57.1	0.759	0.870 (0.356-2.127)
Residence							
	Countryside	130	58.8	91	41.2	<0.01	1
	Capital	70	27.1	188	72.9		3.837 (2.615-5.630)
Education							
	University/Collegue	2	100	0	0		1
	Illeterate	63	47.7	69	52.3	0.142	2.734 (2.354-3.175)
	1st-4th grade	109	36.6	189	63.4	0.029	1.583 (1.045-2.397)
	5th-8th grade	24	55.8	19	44.2	0.357	1.278 (0.757-2.157)
	High school	2	50.0	2	50.0	0.929	1.092 (0.158-7.532)

Table 2 – Number and percentage of patients according to tobacco and alcohol consumption

| Variables		Study Group		Control Group		p	OR (95% CI)
		N	%	N	%		
Smoker							
	No	10	11.9	74	88.1		1
	Yes	143	60.6	93	39.4	<0.001	11.3 (5.5-23.1)
	Past	47	29.6	112	70.4	0.002	1.3 (1.15-1.61)
Drinker							
	No	20	25	60	75		1
	Yes	109	47.2	122	52.8	0.001	2.68 (1.51-4.73)
	Past	71	42.3	97	57.7	0.01	1.29 (1.08-1.55)

significant risk factors (OR=1.79 95% CI 1.01–3.21 p<0.05) (Figure 1)

Multivariate analysis, adjusted for smoking, alcohol consumption and place of residence, showed the consumption of dairies (OR=0.10 95% CI 0.01–0.91 p<0.05), fish, raw vegetables and salads (OR=0.46 95% CI 0.25–0.85 p<0.01), fresh tomatoes and other types of vegetables, citric fruits, apples and pears (OR=0.41 95% CI 0.24–0.69; p<0.05) to be independent protection factors. Cake and dessert consumption remained as

Food	OR (95% CI)
Dairy Products	0.15 (0.02 - 1.19)
Cereals	1.44 (0.13 - 15.96)
Beef	1.71 (1.58 - 1.85)
Pork	1.52 (0.83 - 1.19)
Chicken	0.92 (0.34 - 2.48)
Other types of meats	1.79 (0.82 - 3.90)
Fish	0.45 (0.23 - 0.88)
Sausages	1.26 (0.73 - 2.16)
Eggs	1.82 (0.90 - 3.69)
Tubers	0.48 (0.27 - 0.84)
Salads and Vegetables	0.36 (0.20 - 0.64)
Crucuferous	0.47 (0.28 - 0.78)
Fresh tomatoes	0.40 (0.22 - 0.76)
Grains	2.11 (0.56 - 7.88)
Other types of vegetables	0.25 (0.09 - 0.73)
Fresh fruit juice	0.25 (0.13 - 0.51)
Apples and pears	0.36 (0.22 - 0.59)
Citric fruits	0.32 (0.16 - 0.62)
Bananas	0.52 (0.21 - 1.26)
Other types of fresh fruits	0.85 (0.27 - 2.72)
Cakes and desserts	1.79 (1.00 - 3.21)

Figure 1 – Univariate analysis of the alimentary habits of the patients with oral and orapharynx cancer in Goais, Brazil (ORs and 95% CI)
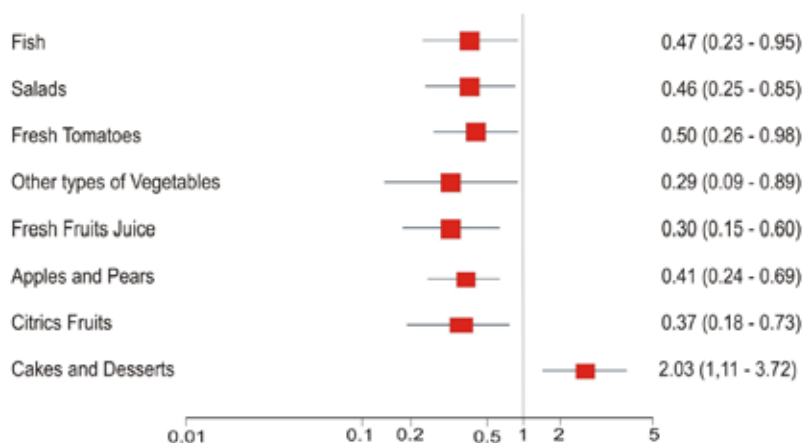
Figure 2 – Multivariate analysis of dietary habits following adjustment for smoking (ORs and 95% CI)

independent risk factors for these types of cancer (OR=2.03 95% CI 1.11–7.72; p<0.02) (Figure 2).

Discussion

Most patients in this study were males over 40 years of age, and it is well-established in the literature[1-6,10,17] that age and being a male are risk factors for cancer of the mouth and oropharynx. The analysis of dietary habits in this study showed that consumption of fish offers protection against cancer of the mouth and oropharynx. This protection may be attributed to the presence of polyunsaturated fats that promote the growth, integrity and regeneration of the epithelium, reducing the occurrence of cancer precursor lesions.[11,19]

According to the literature, beef, pork and chicken have been reported to be risk factors for oral cancer; however, in our study, these were not statistically significant in multivariate analysis.

Cooking methods are known to affect the polycyclic aromatic hydrocarbon content of foods. Heterocyclic amines formed during the preparation of red meat are potent mutagenic and carcinogenic agents, increasing the risk of cancer of the mouth and oropharynx. They also contain a high level of saturated fats, which increase in 17.5% the risk of cancer of the upper aerodigestive tract [11, 19].

Consumption of dairy products was not found to be a statistically significant protective factor in our study. La Vechia et al (1991) [20] reported that the consumption of dairy products was a protective factor against cancer of the oral cavity and oropharynx due to the presence

of calcium and vitamin A in these products, although skimmed milk contains calcium but not vitamin A. McLaughlin et al.[21] reported that the consumption of milk and dairy products is positively associated to oral cancer, with a relative risk of 1.07 after adjustment for smoking and alcohol consumption and for male gender; however, there is no increased risk for women. The increased risk may be explained by the interaction of retinoic acid, contained in milk, with ethanol, producing prooxidant and carcinogenic agents.[8-10]

A diet rich in salads containing legumes and vegetables such as cruciferous vegetables, fresh tomatoes and citric fruits, as well as juice from these fruits, was found in this study to be a protective factor against cancer of the oral cavity and oropharynx. Fruit and vegetables, especially when consumed raw, have a high micronutrient content, including carotenoids (α–carotene and β–carotene), vitamin C (an anti-cancer agent since it inhibits the formation of nitrosamines, amines and nitrites) and vitamin E (an antioxidant vitamin), selenium, fibers, flavonoids, phenols and proteinase inhibitors that protects against oral cancer. Uscudum et al. [19] showed that cooked vegetables provide less protection since during cooking food loses part of its micronutrients. It is possible that diets with a high level of vitamin C derived from fruit and vegetables may reduce the risk of cancer of the mouth and oropharynx; however, studies on other components of diet, such as retinol, folate and vitamin E, have shown conflicting results; therefore, there is still no consistent evidence available on which to form reliable judgments.[8]

Fruit offers better protection than vegetables because it has higher quantities of phenols, aromatic isocyanates and flavonoids; however, further studies need

to be carried out on these substances to fully evaluate their effects.[20]

A fiber-rich diet has a protective effect against oral leukoplakia and submucous fibrosis, which are considered pre-neoplastic lesions.[22] Consumption of foods with high sugar content increases the risk of cancer of the oral cavity and oropharynx. In the present study, analysis of these types of foods showed a 1.79 higher risk for these neoplasias. This is due to the accumulation of sugar in the mouth and to poor oral hygiene, which allow the proliferation of bacteria and the occurrence of caries, which are considered irritative factors for the oral mucosa, tongue and gums.[5,23,24]

Conclusion

Dietary habits are important in the prevention of cancer of the oral cavity and oropharynx. Our data show that diets rich in vegetables, fruit and fish offer protection against these cancers. We suggest that the population should be encouraged to develop healthy and defensive dietary habits through educational campaigns that would also stimulate the combat of alcohol consumption and smoking.

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