Dirce Maria Lobo Marchioni[I]

Regina Mara Fisberg[I]

José Francisco de Góis Filho[II]

Luiz Paulo Kowalski[III]

Marcos Brasilino de Carvalho[IV]

Márcio Abrahão[V]

Maria do Rosário Dias de Oliveira Latorre[VI]

José Eluf-Neto[VII]

Victor Wünsch Filho[VI]

[I] Departamento de Nutrição. Faculdade de Saúde Pública (FSP). Universidade de São Paulo (USP). São Paulo, SP, Brasil

[II] Departamento de Cabeça e Pescoço. Instituto do Câncer Arnaldo Vieira de Carvalho. São Paulo, SP, Brasil

[III] Departamento de Cabeça, Pescoço e Otorrinolaringologia. Hospital do Câncer A.C.Camargo. São Paulo, SP, Brasil

[IV] Departamento de Cabeça e Pescoço. Hospital Heliópolis, São Paulo, SP, Brasil

[V] Departamento de Otorrinolaringologia, Cabeça e Pescoço. Hospital São Paulo. Universidade Federal de São Paulo. São Paulo, SP, Brasil

[VI] Departamento de Epidemiologia. FSP-USP. São Paulo, SP, Brasil

[VII] Departamento de Medicina Preventiva. Faculdade de Medicina. USP. São Paulo, SP, Brasil

Correspondence:
Dirce Maria Lobo Marchioni
Departamento de Nutrição
Faculdade de Saúde Pública da USP
Av. Dr. Arnaldo, 715
01246-904 São Paulo, SP, Brasil
E-mail: marchioni@usp.br

Dietary patterns and risk of oral cancer: a case-control study in São Paulo, Brazil

Padrões dietéticos e risco de câncer oral: estudo caso-controle em São Paulo

ABSTRACT

OBJECTIVE: To analyze the association between dietary patterns and oral cancer.

METHODS: The study, part of a Latin American multicenter hospital-based case-control study, was conducted in São Paulo, Southeastern Brazil, between November 1998 and March 2002 and included 366 incident cases of oral cancer and 469 controls, frequency-matched with cases by sex and age. Dietary data were collected using a food frequency questionnaire. The risk associated with the intake of food groups defined *a posteriori*, through factor analysis (called factors), was assessed. The first factor, labeled "prudent," was characterized by the intake of vegetables, fruit, cheese, and poultry. The second factor, "traditional," consisted of the intake of rice, pasta, pulses, and meat. The third factor, "snacks," was characterized as the intake of bread, butter, salami, cheese, cakes, and desserts. The fourth, "monotonous," was inversely associated with the intake of fruit, vegetables and most other food items. Factor scores for each component retained were calculated for cases and controls. After categorization of factor scores into tertiles according to the distribution of controls, odds ratios and 95% confidence intervals were calculated using unconditional multiple logistic regression.

RESULTS: "Traditional" factor showed an inverse association with cancer (OR=0.51; 95% CI: 0.32; 0.81, p-value for trend 0.14), whereas "monotonous" was positively associated with the outcome (OR=1.78; 95% CI: 1.78; 2.85, p-value for trend <0.001).

CONCLUSIONS: The study data suggest that the traditional Brazilian diet, consisting of rice and beans plus moderate amounts of meat, may confer protection against oral cancer, independently of any other risk factors such as alcohol intake and smoking.

KEYWORDS: Mouth neoplasms, epidemiology. Diet. Eating behavior. Diet surveys. Case-control studies. Factor analysis.

RESUMO

OBJETIVO: Analisar padrões dietéticos relacionados com o câncer oral.

MÉTODOS: Estudo caso-controle de base hospitalar, parte de um estudo multicêntrico na América Latina, foi realizado em São Paulo entre novembro de 1998 e março de 2003 em 366 casos incidentes de câncer oral e 469 controles, pareados por freqüência de sexo e idade. O inquérito dietético foi realizado por questionário de freqüência alimentar. Analisou-se o risco associado ao consumo de grupos de alimentos definidos *a posteriori*, por análise fatorial. O primeiro fator, denominado "prudente", caracterizou-

se pelo consumo de vegetais, frutas, queijos e aves. O segundo, "tradicional", pelo consumo de arroz e massas, leguminosas e carne, enquanto o terceiro, "lanches", pelo consumo de pão, manteiga, embutidos, queijos e doces. O último, "monótono", associou-se inversamente ao consumo de frutas e vegetais, e a maior parte dos outros itens alimentares. Calculou-se um escore para cada padrão derivado, para casos e controles. Após categorização dos escores em tercis, de acordo com a distribuição dos controles, estimou-se a *odds ratio* e o intervalo de confiança de 95% por regressão logística múltipla não condicional.

RESULTADOS: O padrão "tradicional" relacionou-se inversamente com o câncer oral (OR=0,51; IC 95%: 0,32; 0.81, p=0,140), enquanto o padrão "monótono" associou-se positivamente (OR=1,78; IC 95%: 1,78; 2,85, p<0,001).

CONCLUSÕES: Os resultados sugerem que o prato tradicional do brasileiro, composto de arroz e feijão, mais quantidades moderadas de carne, pode conferir proteção quanto ao câncer oral, independente de outros fatores de risco reconhecidos, como consumo de álcool e tabaco.

DESCRITORES: Neoplasias bucais, epidemiologia. Dieta. Comportamento alimentar. Inquéritos sobre dietas. Estudos de casos e controles. Análise fatorial.

INTRODUCTION

The role of diet in the etiology of oral and pharyngeal cancer remains unresolved. The most consistent results show decreased risk associated with the consumption of fruit and vegetables, but available evidence is still inconsistent for other diet components.[20,25] Further studies on the relationship between food and food groups and the risk of oral cancer are therefore of great interest. Diet has traditionally been studied in terms of the effects of certain nutrients or foods on disease. However, in addition to the complex composition of food, the diversity of combinations between foods in the diet may lead to competition, antagonism, or alteration in the bioavailability of certain nutrients. From an epidemiological viewpoint, diet represents a complex set of exposures that are highly correlated. Thus, the true relationship between the range of compounds present in a food item and disease may be erroneously attributed to a single compound, given of the multicollinearity that exists between nutrients and foods.[24]

Analysis of the intake of foods as combinations, which can lead to the identification of patterns, is an alternative for dealing with such complexity. This approach is of particular value if the effect of diet is not measured according to one or two specific nutrients, but it is based instead on nutrients that may operate interactively.[24] Two approaches have been used for developing a general descriptor for the dietary pattern. The first approach, called *a priori*, is based on prior knowledge of the favorable or unfavorable ef-

fects of various constituents of the diet. The alternative approach, *a posteriori*, is based on dietary data obtained directly from the studied population. The main technique used for the latter approach is the analysis of principal components and subsequent factor analysis.[22] The aim of this procedure was to transform a large set of correlated variables into a smaller set of non-correlated variables that are called principal components. In factor analysis, instead of arbitrarily adopting a diet indicator, data objectively point towards how the measurements aggregate. This technique allows for the identification of the structure underlying the data matrix, reducing data so as to provide a synthetic measurement of the diet. Factor analysis derives dimensions that, when interpreted and understood, describe the data as a much smaller set of items than that yielded by the analysis of individual variables.[7]

Together, cancers of the oral cavity and pharynx, excluding those of the nasopharynx, are the fifth type of cancer in incidence worldwide.[25] The Instituto Nacional do Câncer (INCA -Brazilian National Cancer Institute) estimates that cancer of the oral cavity accounts for 2.9% of all malignant neoplasms. The crude incidence of oral cavity cancer for 2006 was estimated at 10.91 per 100,000 men and 3.58 per 100,000 women. Among males, this rate rises to 15.33 per 100,000 in the Southeastern region and 17.20 per 100,000 in the state of São Paulo. In the city of São Paulo, incidence increased 39% among males and 179% among females between 1969 and 1998.[26] Between 1980 and 1995, age-adjusted mortality rates

increased from 2.5 to 2.7 per 100,000 males and from 0.6 to 0.7 per 100,000 females.[26] Overall cancer mortality was stationary in the city of São Paulo in the same period.[1]

The analysis of dietary patterns may help to understand the influence of diet on risk of oral cancer. The present study was thus aimed at assessing associations between dietary patterns, identified through exploratory factor analysis, and oral cancer.

METHODS

This hospital-based case-control study was part of an international study carried out in Latin America and coordinated by the International Agency for Research on Cancer (IARC). Between November 1998 and March 2002, 815 patients were recruited to the study, of whom 366 were histologically confirmed incident cases of oral cavity, oropharynx and hypopharynx cancer cases (median age: 55.5 years). Cases were recruited from seven hospitals in the municipality of São Paulo, and were required to be living in the São Paulo metropolitan area for at least one year. Subjects included cases of cancer classified as International Classification of Diseases (ICD-10) codes C00 to C14 (oral cavity and oropharynx), with the exception of cases classified as C00.0, C00.1, and C00.2 (cancer of the external lip), and C11 (cancer of the nasopharynx). The latter were excluded based on evidence in the literature that cancers in these sites do not share the same risk factors. A total of 469 controls (median age: 56.5 years) were selected from patients admitted to the general hospitals participating in the study due to conditions unassociated with risk factors for oral cavity and pharynx cancer. These conditions included digestive tract diseases (24%), circulatory diseases (21%), genitourinary tract diseases (9%), and external causes (9%), among others. Controls were paired to cases by sex and age (in five-year intervals) according to the expected distribution of cases (frequency pairing). Controls were required to have no past or present history of actual or suspected oral cavity or pharynx cancer.

Information on lifestyle, smoking, and alcohol intake was obtained by trained interviewers, using a detailed open-ended questionnaire developed by IARC.

Dietary information was collected using a semiquantitative food frequency questionnaire (FFQ) developed by IARC, and translated into Portuguese. The validity and reproducibility coefficients, estimated for the study conducted in São Paulo, between 2003 and 2004, presented a median value of 0.39 and 0.35 respectively.[13] The FFQ list contained 27 foods, food groups,

or preparations. Study subjects were asked to report their average weekly intake frequency, before the emergence of disease symptoms, for each item in the FFQ. This was an open question, allowing variables to be treated as continuous. The final number of food items included in the analysis was reduced to 21 as a result of the elimination of food items that were reported as never or rarely consumed.

Smoking was measured by considering the subject's lifetime smoking experience. Experience was defined as the cumulative exposure to the number of packs of cigarettes consumed per day: tobacco in packs x years of exposure. The consumption of cigarettes, cigars and pipe tobacco was considered. One cigarette was considered as corresponding to one gram of tobacco. One cigar corresponds to four cigarettes, and one filling of pipe tobacco to three cigarettes.[9] Mean daily consumption of cigarette packs was thus established, and this value was multiplied by the number of years for which the subject had been a smoker.

For alcohol consumption, it was considered mean daily alcohol intake in grams. For this, the consumption of alcoholic beverages reported by the subject was first transformed into grams of alcohol. The following conversion factors to grams of alcohol per liter of alcoholic drink were used: beer, 40 g; wine, 96 g; *cachaça* (sugarcane spirit), 328 g; and liqueurs, 240 g.

Factor analysis was used to identify dietary factors or combinations of foods consumed by the studied sample. Factor analysis is a generic name given to multivariate statistical analysis that is applied to the identification of factors in a set of performed measurements. Such factors would correspond to indicators. In this method, all variables are considered simultaneously, each one in relation to the other.[7,10]

Principal component analysis was used for the extraction of the factors. This method studies the spatial distribution of the objects so as to identify groupings and the relationships between them. The first factor to be extracted accounts for the maximum possible variance in the data set. The second component, independent from the first, explains as much of the remaining variance as possible, and so on, without any correlation between the components.[7,10]

When determining the number of factors to retain, it is common practice to consider all factors with eigenvalues greater than 1, which indicates that the factor at hand describes more of the variability in the data than does an original variable for the factor individually.[7] However, it was decided to select only factors lying above the inflection point on the curve,
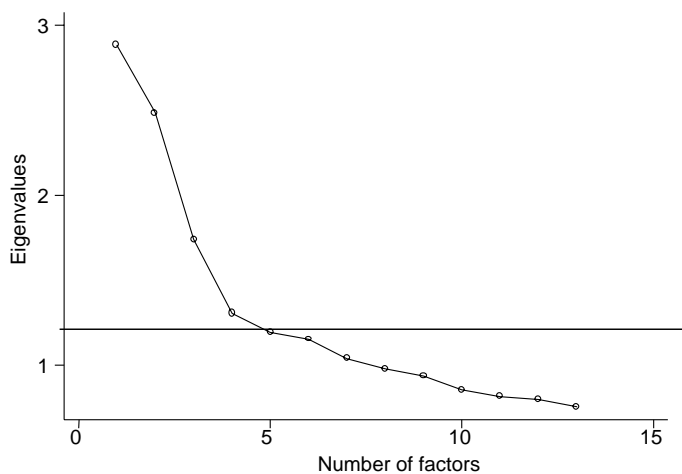
Figure - Scree plot - Dispersion graph for the eigenvalues of retained factors.

since these correspond to the factors with greater joint variance. It was thus retained only factors with eigenvalues of more than 1.25 (Figure). This limited the number of factors, thus retaining only those with greater interpretability and significance, in accordance with the procedure adopted by Slattery et al[17] (1998), Schulze et al[15] (2001).

Factor loadings – measures of correlation between derived factors and the original measures – were analyzed after orthogonal rotation using the varimax method.[7,10] That is, each factor is independent of the others, maintaining axes at 90°. This operation allows for simpler structure, by means of the distribution of the explained variance among the individual components, thus increasing the number of higher and lower factors. Factor loadings of more than 0.25 were considered as significantly contributing to the factor. Within a factor, negative loadings indicate that the food group is inversely associated with the factor, while positive loadings indicate direct association. The higher the factor loading of a food group, the greater the contribution of that group to the factor, since the square of the factor loading corresponds to the percentage variance of the food group that is explained by the factor. Labels were assigned to each factor on the basis of an approximate description of the food items most highly represented. Factor scores for each component retained were calculated for cases and controls.[7] Subjects were assigned scores to indicate the degree to which their diet adhered to each factor retained. Factor scores were categorized into tertiles based on the distribution of the control population.

To determine the associations between dietary factors and oral cancer, odds ratios and 95% confidence

Table 1 - Description of the study population used in factor analysis of dietary patterns and risk of oral cancer. São Paulo, Brazil, 1998-2002.

Variable	Case (n=366)		Control (n=469)		p-value (χ²)
	N	%	N	%	
Sex					
Male	310	84.7	370	78.9	*
Female	56	15.3	99	21.1	
Age (years)					
<40	19	5.2	40	8.5	*
40-50	93	25.4	102	21.7	
50-60	130	35.5	135	28.8	
60-70	84	23.0	118	25.2	
≥70	40	10.9	74	15.8	
Schooling**					
Illiterate	47	12.8	65	13.9	0.200
First four grades of elementary school	202	55.2	225	48.2	
Complete elementary school	64	17.5	93	19.9	
High school	42	11.5	57	12.2	
University	11	3.0	27	5.8	
Region of birth***					
North/ Northeast/ Midwest	98	27.1	164	35.5	0.036
Southeast/ South	255	70.4	288	62.3	
Outside Brazil	9	2.5	10	2.2	
Smoking (pack-years)					
0-1	20	5.6	142	31.2	<0.001
1-25	100	27.9	140	30.8	
25-50	142	39.7	118	25.9	
≥50	96	26.8	55	12.1	
Mean alcohol consumption (g/d)					
Non-drinker	26	7.1	142	30.9	<0.001
0.01-40	112	30.8	174	37.9	
40-80	70	19.2	62	13.5	
80-120	46	12.7	27	5.9	
≥120	110	30.2	54	11.7	

*Matched variables of the study
**3 individuals without information
***11 individuals without information

intervals were calculated using sex and age-specific unconditional logistic regression models. In this analysis, previously known risk factors smoking and alcohol consumption were considered. In addition, other potential confounders were included in statistical modeling, including schooling, region of birth, reported weight two years before the interview, and total number of portions of food items consumed.

For multivariate analysis, control variables with p-values (descriptive significance level of the test) less than or equal to 0.20 in univariate analysis were selected. These variables were then introduced into the regression model using a stepwise procedure. Variables that remained significant after adjustment for the other variables were kept in the model. Even though schooling did not alter any of the associations found, this variable was maintained in the model, since it may be considered as a proxy for social and economic status, thus constituting an important factor in the selection of foods for consumption. The dose-response effect was tested using the χ^2 test for linear trend, adjusted for sex, age, smoking, and alcohol consumption.

All analyses were performed using Stata software.

Written consent was obtained from both cases and controls. The present study was approved by the National Research Ethics Committee (CONEP).

RESULTS

The majority of subjects were male, aged 50 years or older, and with low schooling (Table 1). There was no difference in terms of schooling between cases and controls.

Four factors were retained (Table 2) after principal component analysis. The first four factors chosen accounted for 40% of total variance, i.e., these factors together explained 40% of the variation in the original measurements.

The factor loadings obtained for each dietary variable in each factor are presented in Table 2. Values of more than 0.25 have been shaded in grey, and are considered as having significantly contributed to the factor.

The first factor had significant contributions from vegetables, fruit, cheese, and poultry. This factor was labeled "prudent." The second factor was named "traditional," since foods contributing significantly to this factor were rice and pasta, pulses and beef. The third factor was characterized by significant contributions from bread, butter, cheeses, sandwich meats, eggs, and pork, and was called "snacks." Only a few foods contributed to the fourth factor, namely sandwich meats and potatoes. However, negative correlations with fruit, vegetables and dairy products were observed, and this factor was therefore named "monotonous."

Table 3 shows the results for the associations between food groups, identified by factor analysis, and oral cancer.

Consumption in the highest tertile of the "traditional" pattern was shown to be protective in relation to oral

Table 2 - Matrix of factor loadings for cases and controls participating in the study. São Paulo, Brazil, 1998-2002.

| Variable | Factor | | | | Commonality |
	1 Prudent	2 Traditional	3 Snacks	4 Monotonous	
Milk	0.00	-0.04	**0.26**	**-0.48**	0.70
Butter	-0.10	0.10	**0.65**	-0.22	0.51
Bread	-0.10	0.12	**0.64**	**-0.27**	0.49
Rice and pasta	0.01	**0.95**	0.02	-0.02	0.10
Beef	0.01	**0.95**	0.02	-0.02	0.10
Pork	-0.03	0.05	**0.32**	0.25	0.83
Poultry	**0.25**	0.21	-0.20	-0.11	0.84
Sandwich meat	0.24	-0.09	**0.48**	**0.26**	0.63
Egg	0.11	0.15	**0.38**	0.09	0.81
Cheese	**0.39**	-0.17	**0.41**	0.01	0.65
Brassica	**0.63**	-0.02	-0.10	0.02	0.59
Carrot	**0.71**	-0.08	-0.06	-0.10	0.47
Tomato	**0.59**	0.02	0.11	-0.08	0.63
Juice	**0.35**	-0.06	0.22	**-0.37**	0.69
Apple	**0.41**	-0.10	0.11	**-0.35**	0.68
Banana	0.10	0.10	0.07	**-0.64**	0.57
Potato	**0.41**	0.14	0.16	**0.27**	0.71
Raw vegetable	**0.57**	0.12	-0.05	-0.16	0.63
Citrus fruit	0.18	0.09	0.18	**-0.57**	0.61
Pulse	-0.11	**0.65**	0.11	0.02	0.56
Sweet and dessert	0.08	0.11	**0.44**	0.01	0.79
% explained variance	14	12	8	6	
% cumulative variance	14	26	34	40	

Bold values: Factor loadings of more than 0.25 were considered as significantly contributing to the factor

Table 3 - Odds ratios and 95% confidence intervals for oral cancer, obtained using multiple non-conditional logistic regression, in approximate tertiles for food groups defined a posteriori by factor analysis. São Paulo, Brazil, 1998-2002.

Factor	Tertile of score	Case:control	OR (95% CI)*	OR (95% CI)**	Trend***
Prudent	1st	155:137	1.00	1.00	0.971
	2nd	155:112	0.83 (0.63; 1.44)	0.95 (0.63; 1.44)	
	3rd	155:112	0.82 (0.59; 1.14)	1.05 (0.63; 1.64)	
Traditional	1st	155:124	1.00	1.00	0.140
	2nd	155:126	1.01 (0.731; 1.41)	0.76 (0.50; 1.17)	
	3rd	155:111	0.90 (0.64; 1.26)	0.51 (0.32; 0.81)	
Snacks	1st	155:139	1.00	1.00	0.366
	2nd	155:94	0.67 (0.47; 0.95)	0.83 (0.54; 1.28)	
	3rd	155:128	0.92 (0.66; 1.28)	1.03 (0.64; 1.64)	
Monotonous	1st	155:69	1.00	1.00	<0.001
	2nd	155:110	1.60 (1.09; 2.31)	1.48 (0.93; 2.34)	
	3rd	155:180	2.63 (1.84; 3.76)	1.78 (1.12; 2.85)	

*Univariate
**Adjusted for sex, age, smoking and alcohol consumption, weight, schooling, number of portions, and region of birth
***Mantel-Haenszel χ^2 for trend, adjusted for sex, age, and smoking and alcohol consumption

cancer, independent of alcohol consumption, smoking, and other control variables.

On the other hand, the high consumption of the fourth factor (monotonous) was associated with increased risk of oral cancer (OR=1.78, 95% CI: 1.12; 2.85, p-value for trend <0.001).

The prudent and snacks patterns were not associated with oral cancer.

DISCUSSION

In addition to the relative scarcity of studies on diet and oral cancer, an even smaller number of studies analyze consumption patterns. Little is known about the association between dietary patterns and high risk of oral cancer.[25] In the present study, the dietary patterns of participating subjects were identified using principal component analysis, and these patterns were used for estimating the risk of oral cancer. The pattern identified as "traditional," characterized by the consumption of rice, beans and meat, was inversely associated with oral cancer, in an independent manner. Pulses, also known as legumes, have aroused special interest as potentially protective against cancer, and the World Research Cancer Fund[25] recommends that studies be carried out to elucidate this potential effect.

Despite the convincing evidence for a reduction of the risk of developing oral cancer in association with the consumption of fruit and green vegetables, such an effect was not observed in the present study for higher consumption of the prudent pattern, which is characterized by the presence of these food groups. In its turn, the third factor, "snacks," was characterized by the presence of foods that have been associated with increased risk for the development of chronic non-transmittable diseases. These include processed meats, which have high sodium and saturated fat content, and sweets, which contain carbohydrates

with high levels of levels. However, no increase in risk was observed for higher intake of this pattern. Despite recommendations for limiting the intake of such foods,[25] the results of studies investigating the risk associated with the intake of these foods are contradictory.[4-6,12,18,21]

According to the adjusted risk estimate, it was found that subjects with scores in the highest tertile of the monotonous pattern, characterized by a negative association with the consumption of fruit and vegetables, were at greater risk of oral cancer than subjects with lower scores. Franceschi et al[5] (1999), in an analysis of the diversity of fruit and vegetable intake, found that consumption of various types of fruits and vegetables seemed to protect against the development of oral cancer.

Since dietary patterns were extracted from data obtained within the study population, it is reasonable that the results are not reproduced in populations with different dietary habits. The patterns extracted in the present study were different from those retained in previous studies on adult populations.[8,15,17,19] However, similar to what was detected by Sichieri[16] (2002), in a study conducted in Rio de Janeiro, Brazil, the present study also found a pattern characterized by rice and beans. In the only study published to date investigating the association between dietary patterns identified by factor analysis and risk of oral cancer – a case-control study[19] conducted in Uruguay – the authors found a direct association between risk and a pattern characterized by the consumption of cooked beef, cooked vegetables, potato, and sweet potato. They also found an inverse association with a pattern including raw vegetables, citric fruit, other fruit, liver, fish, and desserts. It should be noted that patterns are comparable only if food groups are similar and, equally, if factor loadings are of similar magnitude. This feature of the method may lead to difficulties in reproducing risk estimates in different study popula-

tions. Despite this drawback, an advantage of this approach is that the description of dietary patterns allows the promotion of changes to be focused on the consumption of foods that are readily recognized by the target group. It is stressed that, at present, dietary guides are issued with emphasis on foods and on overall dietary patterns.[11]

The intake of a given food may be highly correlated with the intake of other foods, as well as to individual lifestyle. Theoretically, this could be modeled statistically, with adjustment for confounding variables. However, it is difficult to judge how adequate such adjustments are. The use of the multivariate analysis technique reduces the possibility that statistically significant results might be obtained by chance. Other advantages are the transformation of correlated variables into non-correlated variables, and the reduction of the number of explanatory variables to be used in subsequent analyses.

In factor analysis, as in other statistical methods, certain decisions are made arbitrarily. Such decisions include the choice of variables to be included in the model, the number of factors to be retained, and how these factors are named. In the present study, virtually all dietary variables that appeared in the FFQ were included. These variables were then grouped into factors, which were linear combinations of the data. The retained factors did not represent all possible patterns, as indicated by the proportion of the explained variability of the diet that these factors represented. Nonetheless, this method allowed to identifying plausible and interpretable patterns.

Other important variables include the smoking and alcohol consumption, which are the two most important and widely acknowledged risk factors for oral cancer. Dallongeville et al[2] (1998) conducted a meta-analysis on the nutrient intake associated with the habit of smoking. These authors observed that smokers showed lower intake of fiber, vitamin C, vitamin E, and beta-carotene, which are nutrients correlated with the intake of fruit and vegetables, alongside greater consumption of alcohol and energy. Chronic alcoholism also interferes with nutritional status, and induces depletion of vitamins and minerals. Alcohol may also be able to modify the individual's immunological response.[23] The questionnaire used in the survey allowed to attaining detailed knowledge of subjects' exposure to tobacco and alcohol, in terms of the time period, duration, and intensity of exposure.

The variables incorporated in the adjustments to the statistical model allowed the mean consumption by study subjects over their lifetime to be taken into account.

Establishing the role of calorie intake in carcinogenesis is a difficult task, and this is a factor that must be controlled for in studies of diet and cancer. When calorie intake increases or diminishes, there are parallel increases or reductions in other diet components that may promote or protect against cancer. One of the most commonly used approaches is to adjust for calories using the residuals method. However, the value of this approach has been recently put into doubt by studies showing that individual weight is more closely associated with energy expenditure than with estimated energy intake. Thus, Day & Ferrari[3] (2002) suggested that, in order to adjust for energy intake, using weight as a surrogate may be a better option than using energy per se. In the present study, it was used the simultaneous adjustment for reported weight before the onset of symptoms and the number of portions consumed.

A trend towards lesser consumption of staple foods such as rice and, especially, beans has been reported in the literature. A comparison of the 1987 and 1996 Brazilian national family budget surveys shows reductions of 16% and 32% in the consumption of rice and beans, respectively. On the other hand, there was a substantial increase in the consumption of proteins, represented by beef and chicken, in consonance with the nutritional transition.[14] In fact, in the present study, it was not the "traditional" pattern that explained the greatest variance in dietary intake. If this pattern is really favorable in terms of the prevention of oral cancer, this is a further motivation for reversing the trend towards adopting the dietary patterns of affluent societies, one well known consequence of which is the increase in the burden of chronic noncommunicable diseases.

In conclusion, of the dietary patterns identified among the studied population using factor analysis, the "traditional" pattern, characterized by the consumption of staple foods that are typical of the Brazilian diet, was associated with decreased risk of oral cancer. In addition, the "monotonous" pattern, characterized by low consumption of fruit and vegetables, was associated with increased risk, which is consistent with the recommendations for raising consumption of these foods as a form of protection against this type cancer.

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