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A Prospective Case Control Study of Dietary Habits of Head and Neck Cancer Patients at a Comprehensive Care Cancer Centre in Rural India

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ABSTRACT: Unhealthy diet is one of the major risk factors of cancer. Major challenge in cancer research is to find out dietary habits that can significantly reduce the cancer risk, therefore, this clinical study was carried out to test the hypothesis that poor dietary habits are significantly associated with incidence of head and neck cancer (HNC). Various studies conducted till date to find out association between dietary factors and risk of HNC showed controversial results, which indicates questionable role of dietary habits to influence occurrence of HNC. Therefore, in the current prospective study, data of dietary habits of HNC patients were compared with data of their control cohorts at a comprehensive care cancer centre in rural India. Our data suggested that consumption of plant-based foods like fruits reduces overall risk of HNC. Variations in diet, dietary and cooking habits as well as quality of food may be a key factor for differences in findings in various studies.

Keywords: Dietary, HNC, cancer, fruits, vegetable, cancer.

INTRODUCTION

Cancers of the lip and oral cavity are common in South Central Asia, with the highest incidence rate in both sexes. Lip and oral cancer are the second largest cancer in 2020 while third largest cancer-causing mortality in India. It is the leading cause of cancer death in India among men (Sung *et al*., 2021; Globocan, 2020). Head and neck cancers (HNCs) are the second most common cancers in the Indian population (Globocan, 2012). Tobacco chewing and alcohol use are the strongest risk factors for HNC; however, the investigation of other risk factors is also of research interest to find out possible etiological factors for HNC.

Despite continuous advances in cancer research, there is still critical gap in our understanding of the role of poor dietary habits as risk factor of cancers. Diet is one of the important factors that directly affects the health of a person. Since years use of healthy diet is known as one of the best protective measures for majority of the diseases as well as for improvement in quality of life. Literature indicates that about 30 percent of all cancers worldwide are due to improper dietary habits and lack of physical activity and the incidence of cancers could be reduced by making changes in diet, exercise, healthy weight maintenance, in addition to avoiding tobacco use. Dietary habit is probably the second most important factor, after avoiding tobacco use (Globocan, 2020). As very few studies have explored the role of poor dietary habits as risk factor of HNC (Stefani *et al.*, 2005; Stefani *et al.*, 2007; Edefonti *et al.*, 2010; Edefonti *et al.*, 2010; Marchioni *et al.*, 2007), therefore, this study was planned to find out the association between plant-based and animal-based food habits and risk of HNC.

MATERIAL AND METHODS

The current study was performed at Kailash Cancer Hospital & Research Centre, Muni Seva Ashram, Goraj, Vadodara, Gujarat, India. Approval for the conduction of this research study was taken by the Human Ethical Committee of Kailash Cancer Hospital & Research Centre. Study was conducted on 150 participants, i.e. 75 HNC patients as case cohorts and 75 participants without disease as control cohorts. All participants were informed about the purpose of this study and informed consent was taken from all. Participants were assured of confidentiality.

HNC patients and their matched control having age 18 years or above were enrolled for this study. Participants having cancer previously, or having any other malignancy, were excluded. Controls matched by similarity in lifestyle and exposure patterns with patients were selected as control cohorts. The control cohorts were examined to assure that they did not have cancer.

Structured questionnaire was used to record information related to dietary habits of both case controls and their control cohorts. Study information was recorded with the help of a trained interviewer. Data were expressed in percentage and also analyzed statistically using Prism9 for Windows (version 9.0.0 (121), GraphPad software LLC, San Diego, CA, USA). The Chi squared or Fisher's exact test, were used to compare the significance of differences between the case and control groups (probabilities of less than 0.05 were accepted as significant). We calculated odd ratio (OR) and 95% confidence intervals (CI) for HNC risk.

RESULTS

All the participants completed the study. Data collected from all the participants were analyzed. Table 1 shows data related to dietary profile obtained from cases and control cohorts.

A. Plant-based food

Maximum number of participants in both groups were observed to consume fruits twice weekly and vegetables daily. Results indicate that consumption of vegetables was found to be near to similar between control cohorts and patients. Table 2 presents the plant-based food consumption data of cases and their control cohorts. Twice a week (OR = 0.5, 95% CI: 0.2-1.7) or daily fruits (OR = 0.51, 95% CI: 0.13-1.97) intake was associated with a significantly reduced risk of HNC as compared to individuals who never consume fruits. No significant finding for HNC risk was observed between the individuals having daily consumption of fruits and vegetables as compared to those who only had daily consumption of vegetables and those who do not consume fruits and vegetables daily (Table 3).

Table 1: Dietary Variables of cases and their control cohort.

Parameter	Cases (n=75)	Controls (n=75)	*P*
Plant based foods			
Vegetables			
Never	42 (56)	39 (52)	0.74
≥2 times/week	33 (44)	36 (48)	
Fruits			
Never	9 (12)	5 (6.7)	0.40
≥2 times/week	66 (88)	70 (93.3)	
Animal based foods			
Eggs			
Never	59 (78.7)	59 (78.7)	>0.99
≥2 times/week	16 (21.3)	16 (21.3)	
Chicken			
Never	59 (78.7)	63 (84)	0.53
≥2 times/week	16 (21.3)	12 (16)	
Fish			
Never	70 (93.3)	70 (93.3)	>0.99
≥2 times/week	5 (6.7)	5 (6.7)	
Red meat			
Never	75 (100)	75 (100)	>0.99
≥2 times/week	0 (0)	0 (0)	
Liver			
Never	75 (100)	75 (100)	>0.99
≥2 times/week	0 (0)	0 (0)	

*Data are Expressed as Number (%)

Table 2: Fruits and vegetable consumption of cases and their control cohort.

Diet	Cases (n=75) n (%)	Control (n=75) n (%)	OR (95% CI)
Vegetables			
Never	1 (1.3)	1 (1.3)	Reference
Twice-a-week	32 (42.7)	35 (46.7)	0.0 (0.1-15.2)
Daily	42 (56)	39 (52)	1.08 (0.07-17.81)
Fruits			
Never	9 (12)	5 (6.7)	Reference
Twice-a-week	54 (72)	57 (76)	0.5 (0.2-1.7)
Daily	12 (16)	13 (17.3)	0.51 (0.13-1.97)

Table 3: Vegetable and Fruit Consumption of cases and their control cohort.

Daily intake of vegetables	Daily intake of fruits	Cases (n=75) n (%)	Control (n=75) n (%)	OR (95% CI)
Yes	Yes	11 (14.7)	11 (14.7)	Reference
Yes	No	31 (41.3)	28 (37.3)	1.11 (0.42-2.95)
No	Yes	1 (1.3)	2 (2.7)	0.50 (0.04-6.35)
No	No	32 (42.7)	34 (45.3)	0.94 (0.36-2.47)

Table 4: The Association between Vegetables and Fruits consumption and Head and Neck Cancer Risk in Tobacco consumers.

Ever tobacco consumer			
Diet	**Cases n (%)**	**Control n (%)**	**OR (95% CI)**
Tobacco use			
Never consumer	15 (20)	56 (74.7)	Reference
Ever consumer	60 (80)	19 (25.3)	11.79 (5.47-25.43)
Vegetables			
≤2 times/week	29 (38.7)	10 (13.3)	Reference
Daily	31 (41.3)	9 (12)	1.19 (0.42-3.34)
Fruits			
≤2 times/week	50 (66.7)	15 (20)	Reference
Daily	9 (12)	4 (5.3)	0.68 (0.18-2.51)

Tobacco consumption was found to possess strong association with HNC risk (Table 4). Tobacco consumers having daily fruits consumption (OR = 0.68, 95% CI: 0.18-2.51) were observed to possess decreased risk of HNC as compared to tobacco consumers who consumed fruits twice a week.

B. Animal-based food

It was noted that majority of participants from both cohorts never consumed eggs. Results also indicate that majority of participants from control cohort and case cohort were never consumed non-vegetarian food. It was observed that few of participants from both the groups were white meat consumer, while none of the participants was observed to consume red meat. Table 5 presents the animal-based food consumption data of cases and their control cohorts. Egg or fish consumption was not significantly associated with HNC risk. The only significant finding was the increased risk of HNC with consumption of chicken twice a week (OR = 1.4, 95% CI: 0.6-3.3).

Table 5: Animal-Based Food consumption of cases and their control cohort.

Diet	Cases (n=75) n (%)	Control (n=75) n (%)	OR (95% CI)
Eggs			
Never	59 (78.7)	59 (78.7)	Reference
Twice-a-week	14 (18.7)	14 (18.7)	1 (0.4-2.3)
Daily	2 (2.7)	2 (2.7)	1 (0.14-7.34)
Chicken			
Never	59 (78.7)	63 (84)	Reference
Twice-a-week	16 (21.3)	12 (16)	1.4 (0.6-3.3)
Daily	0 (0)	0 (0)	NA
Fish			
Never	70 (93.3)	70 (93.3)	Reference
Twice-a-week	5 (6.7)	5 (6.7)	1 (0.3-3.6)
Daily	0 (0)	0 (0)	NA

DISCUSSION

Cancer is a genetic disease resulted in abnormal multiplication of cells (Singh *et al*., 2021; Sharma, 2022) Nutrition factors are mostly reported as protective. Literature shows that a diet rich in vegetables and fruits is related to a decreased risk of cancer, still since years research studies conducted to find association between dietary factors and cancer risk indicate controversial outcomes (Toledo *et al.*, 2010).

Fioretti *et al*., (1999) found a moderate protection by consumption of carrots and fresh fruit in oral cancer risk. Winn *et al*., (1984) conducted a hospital-based case-control study in the rural southeast US and reported that a diet high in fruits and vegetables was significantly protective for oral and pharyngeal cancer. Franceschi *et al*., (1999) reported that high intakes of vegetables, fruit, fish and vegetable oils, and low intake of soups, cakes, processed meats and eggs were associated with decreased risk for cancers of the oral cavity and pharynx in the Italian study population. Bravi *et al*., (2013) reported that a diet rich in fruit and vegetables and poor in meat and products of animal origin has a favorable role against oral and pharyngeal cancer. Chuang *et al*., (2012) found that in their study high fruit and vegetable intake and low red meat intake, were associated with reduced HNC risk. They also observed an increased risk for consuming more than three eggs per week as compared to less than one egg per week. Our study suggested increase in risk of HNC with consumption of white meat, while we did not observe any association between consumption of egg / fish and HNC risk. We did not have any red meat consumer in our study. Study conducted by Chang *et al*., (2017) supported an inverse association between the consumption of fresh vegetables and fruits and HNC risk. They reported that the highest HNC risk occurred among individuals who had no daily intake of vegetables and fruits. They also found that for those who had only daily intake of vegetables but not fruits, their risk of HNC was lower than those who had neither daily intake of vegetables nor daily intake of fruits. They suggested that daily intake of fruits and vegetables are required to achieve the maximum benefit to reduce the risk of HNC. Kawakita *et al*., (2017) found an inverse association between higher intakes of fruit and vegetables and HNC risk. In contrast to this, Peters *et al.,* (2008) reported that consumption of fruits and vegetables is not universally protective for HNC and that other foods and nutrients may influence the risk for developing this disease. Similar results were reported in other case-control studies of oral cancer where no difference in fruit consumption between cases and controls was observed (Peters *et al*., 2008; Wynder *et al*., 1957). A large population-based case-control study conducted in four regions of the US did not observe a protective association of vegetables consumption on oral and pharyngeal cancer risk, although increased fruit consumption was observed to be statistically associated with a decrease in cancer risk (Graham *et al*., 1977; McLaughlin *et al*., 1988). We found similar results in our study for vegetable consumption. No any significant association between vegetable consumption and HNC risk was observed. The possible reason for this finding may be cooking habits of participants. In Indian villages, overcooked vegetables are consumed commonly, so there are possibilities of loss of majority of nutrients of vegetables during cooking. However, we found the significant decrease in HNC risk with daily consumption of fruits. Despite the strong association between tobacco consumption and HNC risk in rural patients as studied by us earlier (Jani *et al.*, 2023) we observed that daily fruits intake reduces HNC risk in tobacco consumers also. Thus, fruits have protective effect and reduces the risk of cancer.

The major limitation of this study is the small number of participants. Other limitations include lack of information related to quality of fruit and vegetable consumed by participants. Strengths of the study is the participation of close relatives of the patient as control cohort having exposure similarity with patients.

CONCLUSIONS

Despite availability of huge literature in support of beneficial effect of fruits, vegetables, fish and animal products in prevention of various types of cancers, our data indicates that only plant-based diet showed significant benefit against HNC. Daily consumption of fruits, may decrease overall risk, even in tobacco consumers.

FUTURE SCOPE

Data from various research studies indicate controversial results for association between dietary factors and HNC. Variations in cooking and dietary habits across continents and ethnic groups, may be a key factor for differences in findings from the various studies reported to date. Further studies may be conducted to find out other food groups and nutrients that may influence the risk for developing HNC.

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Conflict of interest. None.

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