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A case–control study on diet and colorectal cancer from Mumbai, India

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ABSTRACT

Colorectal cancer is more common in the western countries. Studies have reported on risk factors for colorectal cancer across the globe but no study results are reported yet from India. This is the first hospital-based case–control study on colorectal cancer from India. This study conducted at Tata Memorial hospital, Mumbai, India, included 203 cases of colorectal cancer and 1628 hospital controls. Data was collected on chewing, smoking, alcohol habits and dietary habits. The results indicated no significant excess risk for chewers, smokers and alcohol drinkers compared to those without the habits. However some significant findings emerged regarding the dietary habits. Cabbage-eaters had a 50% reduction in risk among both the sexes, compared to those who did not eat cabbage. Sprout eaters also had an 30–50% reduction in risk. There was an enhanced 1.6-fold risk among men who ate 'dry-fish' compared to those who did not eat dry-fish (OR = 1.6; CI: 1.0, 2.6). Among women, meat-eaters had a 2.4-fold excess risk than non-meat-eaters. Likewise for fresh-fish eaters, there was a 40–70% reduction in risk compared to those who did not eat fresh-fish. Dark-green-leafy-vegetables and 'other vegetables' did not show any protective effect for colorectal cancer in this study.

1. Introduction

Colorectal cancer is the fourth most common form of cancer occurring worldwide. Colorectal cancer is more prevalent in North America, Argentina, Australia, New Zealand and parts of Europe, Japan, and Israel, and for this reason is commonly regarded as a western life-style disease. Although incidence and mortality are higher in western countries, yet majority of the world's cases of colorectal cancer occur outside of countries in which traditional western life-styles are dominant. The profile varies greatly in different populations, and the evidence suggests that this variation is mainly a consequence of different life-style and environmental factors, which should be amenable to preventive interventions. World population growth and ageing imply a progressive increase in the cancer burden; 15 million new cases and about 10 million new deaths are expected in 2020, even if current rates remain unchanged [1].

In Europe, colon cancer incidence varies across the continent; the incidence rates in Bas-Rhin, France, are 31.3 per 10^5 in males and 16.9 per 10^5 in females [2]. In US, highest rates are in New Jersey, 31.3 per 10^5 in males and 23.1 per 10^5 among females; in Asia, higher rates are observed in Japan, Hiroshima (ASR: 59.7 per 10^5 in males and 28.0 per 10^5 in females) and also among the Chinese in Shanghai (11.5 per 10^5 in males and 12.0 per 10^5 in females) [2].

Rectal cancer incidence rates also vary across the world. Highest rates are observed in Japan, Hiroshima (M:ASR = 23.2 per 10^5 and F: 9.99 per 10^5) [2]. In France Bas-Rhin, ASR are 13.76 per 10^5 among males and 5.88 per 10^5 among females; in the United States, California, Los Angeles, show the highest rates (ASR = 13.04 per 10^5) among males and 6.05 per 10^5 among females [2]. In the Indian sub-continent, Mumbai reports an ASR of 2.9 per 10^5 and 1.9 per 10^5 for males and females respectively; however, in the south India, Bangalore has higher ASR rates (M: 3.3 per 10^5 and F: 2.2 per 10^5) [3]. This shows that the rates vary between countries and within the country across the globe.

There are several colorectal cancer studies reported in the literature from different part of the globe, but there is no colorectal case–control study reported from India. Studies elsewhere have indicated alcohol and diet, especially specific diet with high fat content, as possible risk factors for increased risk of colon cancer. Other risk factors reported in the literature are the physical activity, colorectal polyps, obesity, smoking, alcohol intake, family history of colorectal cancer, etc.

In one of the earlier studies on dietary factors, meat intake has been shown to be risk factor for colorectal cancer [4]. High levels of physical activity were the most marked life-style associated with reduced risk for colon cancer [5]. For an average Indian, the amount of physical activity, in terms of household work, farming and other related activities are varying. The Indian population is known to be less obese than the western population, basically attributed to the

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life-style. The body mass index is quite low for Indians. As per the recent NFHS survey [6], the mean BMI for Indian men (15–54 years) is 20.3 and for women (15–49 years) it is 20.5. The Indian diet includes a major portion of vegetables and fruits. Non-vegetarian diet is rarely consumed on a daily basis, unlike in western countries. The present study attempts to determine the various factors associated with colorectal cancer, such as tobacco, alcohol drinking and dietary items.

2. Material and methods

The present study, a hospital-based case–control study, was conducted at the Tata Memorial Hospital (TMH), Mumbai, India. The period of data collection was 1989–1992 that included subjects who visited TMH for diagnosis and treatment. Patients were interviewed at the out-patient department of TMH, prior to diagnosis. The information was recorded in a pre-designed questionnaire that included demographic characteristics (age, sex, religion, etc.), life-style (habits such as smoking, chewing, alcohol drinking, etc.), dietary habits and dietary items. After interviewing the patient, cancer cases and controls were segregated based on the diagnosis. The hospital being a comprehensive cancer centre for diagnosis and treatment attracts patients from all parts of India. In general, in a year 30–40% of patients of total registrations are diagnosed as free of cancer. These cancer-free patients were considered as 'controls' by scrutinizing their medical history and diagnosis. Cases were histologically proven cancer cases of colon and rectum. The present set of data on 'controls' is a part of the dataset used in an earlier study on 'stomach cancer' [7]. Controls were classified as those that were diagnosed by histology as 'free of cancer' and not having any gastro-intestinal tract ailments and thus had 'no evidence of disease' under study. During the period 1989–1992, 2172 patients were interviewed. Of these 1956 were in the age group of 30–75 years and were selected for this study. Of these 1956, 328 who had either infectious disease or benign lesion were excluded. Thus 1628 patients were included as controls. During the year same period, approximately 1100 patients with gastro-intestinal tract cancers were interviewed. There were 203 histologically proven colorectal cancer cases among the interviewed cancer patients (ICD9: 1530–1549). Results of colon and rectum were not analysed separately since the numbers were small. Thus there were 203 cases of 'colorectal' cancers and 1628 controls (unmatched) that were considered as eligible entrants for this study. The questionnaire contained socio-demographic information, life-style habits like chewing, smoking, alcohol consumption and dietary items. The questionnaire on food items were based on recollection of consumption of routine food items prior to 1-year of the date of interview. Information on food frequency per week was also collected. The dietary items were classified as vegetarian diet and non-vegetarian diet. The non-vegetarian diet included items as dry-fish, fresh-fish, chicken and red-meat. Red-meat included mutton, liver, pork, brain, etc. Consumption of specific vegetables was recorded and later classified as dark-green-leafy-vegetables, root vegetables, cabbage, sprouts and 'other' vegetables. In our study, 'Sprouts' mainly included 'pisum sativum' (vatana), 'phaseoulus aureus roxb' (moong), 'phaseolus aconitifolius jacq' (matki), 'vigna catjang' (cow pea) which are commonly consumed in India. Although frequency of consumption was recorded, it was not taken into account for analysis because of incompleteness.

Unconditional logistic regression model was applied for obtaining the risk estimates (odds ratio) and its 95% confidence limits using SPSS Version 15.0 software. In the analysis, independent variables were categorized into binary form and entered into the model. The results were considered for statistical significance at 5%.

Table 1
Demographic characteristics of cases and controls.

	Characteristics	Cases (%) $N = 203$	Controls (%) $N = 1628$
1	*Age*		
	<35	23 (11.3)	218 (13.4)
	35–44	55 (27.1)	428 (26.3)
	45–54	54 (26.6)	452 (27.7)
	55–64	49 (24.1)	342 (21.0)
	65+	22 (10.8)	188 (11.5)
2	*Sex*		
	Females	59 (29.1)	760 (46.7)
	Males	144 (70.9)	868 (53.3)
3	*Residence*		
	Non-Mumbai	133 (65.5)	1021 (62.7)
	Mumbai	70 (34.5)	607 (37.3)
4	*Literacy*		
	Literate	127 (62.6)	934 (57.4)
	Illiterate	76 (37.4)	694 (42.6)
5	*Religion*		
	Hindu	177 (87.2)	1318 (81.0)
	Others	26 (12.8)	310 (19.0)

3. Results

Table 1 describes the patients' characteristics. The age groups are comparable between cases and controls. There is a male predominance in both cases and controls, and is greater in cases. Attendance of patients from Mumbai and outside-Mumbai are similar between cases and controls.

In India, chewers take pan (betel leaf), betel nut, lime and tobacco with some spices and condiments and smokers smoke Indian cigarettes called 'bidi' (obtained by wrapping 0.2–0.3 g of tobacco in tendu leaf), cigarette, chutta (a kind of cigar), hukka and chilum (clay pipe). Bidi smoking is more common than cigarettes. Alcohol is locally brewed liquor, mostly from palm trees (ethanol content 40–60%).

Table 2 shows the risk estimates in terms of odds ratio (OR) and 95% confidence interval (CI) for life-style habits as chewing, smoking, alcohol drinking and occupation for 'men', 'women' and 'both sexes'. Occupation was classified as 'agriculture' and 'non-agriculture'. The estimates are adjusted for age, place of residence and literacy. The table shows that though the risk was not significant for chewers (OR ranging from 0.5 to 0.8) among 'men', 'women' and 'both sexes'; the OR was 0.7 for smokers among 'men' which was not significant. Among alcohol drinkers, although there was an increase in risk (OR = 1.2) in 'men' and 'both sexes' group, it was not significant. Those engaged in 'agriculture' had a minimal increase in risk, the OR ranging from 1.1 to 1.3, and the risk was not statistically significant.

Table 3 details the risk estimates with regard to the dietary items for 'men', 'women' and 'both sexes'. Dietary habits were classified as 'vegetarian' and 'non-vegetarian'. Consumption of 'dark-green-leafy-vegetables', 'root vegetables', 'cabbage', 'sprouts' and 'other vegetables' were analysed. The classification of vegetables is shown in the footnote of the table. Among 'dark-green-leafy-vegetable' eaters, there was no significant decrease in risk for colorectal cancer among 'men', 'women' and 'both sexes' and also there was no reduction in risk for those consuming 'root vegetables' among 'men', 'women' and 'both sexes'. Cabbage-eaters showed a significant reduction in risk among 'men', 'women' and 'both sexes'; among men, there was a 40% reduction in risk (OR = 0.6; CI: 0.3, 0.9) which was statistically significant. There was a 50% reduction in risk for women (OR = 0.5; CI: 0.2, 1.1) for cabbage-eaters compared to those who did not eat cabbage; the risk was not significant but the risk was closer to unity. Similarly, when 'both sexes' were considered, the risk reduced by 50% for