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ORIGINAL: Investigating the Inflammatory Content of the Diet of Colorectal Cancer Patients Referred to Mazandaran Comprehensive Cancer Center during 2022

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ABSTRACT

Introduction: Cancer represents a significant global health challenge, with dietary habits identified as a critical lifestyle risk factor. The importance of this factor is high in gastrointestinal malignancy, so identifying high -risk diets in areas with high prevalence of gastrointestinal cancers, especially in the north of the country, is very important. This study identified the inflammatory potential of diet in patients referring to the Mazandaran Comprehensive Cancer Center compared to the control group during 2022.

Material and Methods: This research employed a case-control design, involving 155 participants, including 77 individuals diagnosed with colorectal cancer confirmed by pathology at Imam Khomeini Hospital in Sari, alongside 78 control subjects who exhibited no gastrointestinal symptoms and had no prior cancer history. Food frequency and demographic data were recorded based on the questionnaire and statistical analysis was performed with SPSS and P <0.05 software.

Results: The analysis revealed no significant differences in the consumption of foods categorized as inflammatory. However, in the anti-inflammatory category, control subjects reported higher consumption of green leafy vegetables and other vegetables.

Conclusion: The findings suggest that promoting a diet rich in vegetables may contribute to a reduction in the incidence of colorectal cancer.

Introduction

Colorectal cancer (CRC) is due to the abberant proliferation of colon and rectal epithelial cells. This cancer is categorized as sporadic (common type), hereditary and colitis-associated cancer (1). Colon cancer accounts for 72% and rectum is 28% of the total CRCs. The CRC, which mainly includes colon and rectal adenocarcinoma, is defined as the conversion of natural colon and rectal epithelium into a pre -cancerous lesion and ultimately to adenocarcinoma that can spread to different round organs. This process involves the accumulation of genetic mutations (2). In addition to genetic factors, lifestyle choices such as lack of physical activity, dietary habits, tobacco use, and obesity play a significant role in increasing the risk of CRC (3). food and nutrition are recognized as the key environmental factors that can lead to an increased risk of cancer (4). Low -grade chronic inflammation is associated with a

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variety of chronic diseases, including cancer. In general, acute inflammation is a useful and essential process for in response to stimuli. However, chronic inflammation can interfere with natural hemostasis (5).

Dietary inflammatory potential with mechanisms such as insulin resistance and activation of cyclooxygenase pathway can play a role in CRC creation (5). high consumption of red and processed meat (foods that have pre -inflammatory properties) are linked to greater risk of CRC, while high consumption of whole fiber and whole grains, fruits and vegetables (foods that have anti -inflammatory properties) may reduce CRC risk (6). Western diet patterns are associated with some of the biological markers of inflammation such as CRP, IL-6 and amyloid A serum. The Mediterranean diet shows a decrease in inflammatory cytokines by increasing the consumption of multiple unsaturated fatty acids, vitamins and fruits and vegetables (7). It is known that the relationship between diet and the incidence of disease in different populations varies. It has also been found that the diet pattern varies between racial and ethnic groups. Also, some reports indicate that the index has a greater impact on CRC risk on men and not women (8, 9). In some studies, dietary findings in the CRC and control group are very close and have not shown significant differences under the continuous variable (10). Given the emergence of CRC, there have been little studies to understand the role of pre -inflammatory diets in the Iranian population. According to the above, in this study we will discuss the relationship between the inflammatory status of the diet and the risk of colorectal cancer in patients referring to the Comprehensive Cancer Center of Imam Khomeini Hospital in Sari.

Methods

The study was a hospital-based case control during 2022. The patient group consists of pathologically confirmed cases with colon or rectum malignancy referred to the Imam Khomeini Hospital Comprehensive Cancer Center. The control group consisted of subjects visiting hospital for medical check-up that had a negative malignancy history and lacking any symptoms or gastrointestinal diseases. Exclusion criteria included having a specific diet that could affect the patient's weight, pregnancy or breastfeeding, medical history of malignancy or colon polyps in the control group (if any).

The nutritional status of subjects was evaluated by food frequency questionnaire. They were asked to specify the frequency of their consumption of each food item according to their consumption in the last year. Depending on the type of food, the frequency of consumption per day, week or month was asked. The mentioned amounts for each food item were converted into grams per day by using the manual of household scales.

Food groups were defined as follows (6):

Pro-inflammatory:

Processed meat, red meat, organ meat (liver, heart …), Seafood other than dark meat fish, other vegetables, refined grains, high energy drinks, low energy drinks, tomatoes.

Anti-inflammatory:

Tea, beer, coffee, leafy green vegetables, yellow and orange vegetables, corn chips / popcorn; or crackers/ fruit juices.

The statistical tests used were T-Test, Mann-Whitney test, Fisher's Exact test and chi Square. $P < 0.05$ was considered a significant level.

Results

In the present study, a total of 155 individuals entered. In control group 60.3% were male and in CRC patients 55.8% were male. According to the chi- squared test, the group did not show a difference in terms of gender ($p = 0.578$).

The average age of the participants in the control group was 58.71 ± 12.48 years and the patient group was 59.17 ± 12.32 years. This finding did not show any statistical difference with the T-test ($P=0.861$) as shown in **figure 1**.

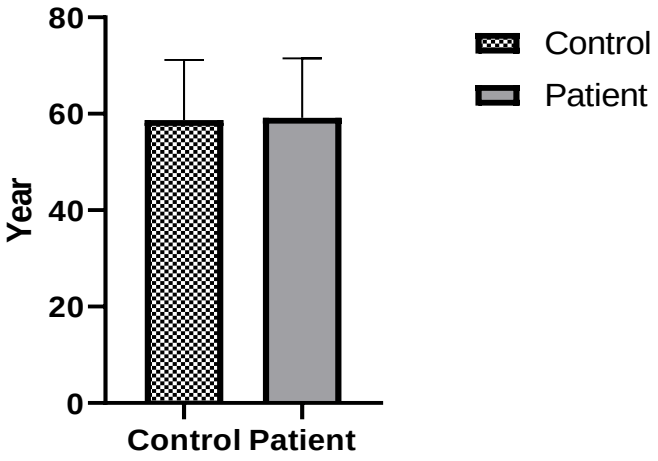

Figure 1. Age histogram of participants

In **table 1**, we have compared the co-morbidities and substance abuse. As shown, the only case of statistical difference observed was related to higher prevalence of hypertension in control group.

There was no significant difference in the amount of food consumption that had pro-inflammatory properties between the control group and the CRC case.

In the analysis of foods with anti-inflammatory properties, consumption of all vegetables except yellow and orange types was higher in the control group. The rest of the food items had no statistical difference (**Table2, 3**).

Table 1. Underlying conditions of the study groups

Variable (N, %)	Control	CRC	P-value
Diabetes	19	14	0.347
Hypertension	29	16	0.024
Smoking	12	10	0.669
Opium	9	4	0.154
Alcohol	6	5	0.771

Table 2. Frequency of consumption of inflammatory foods

Pro-Inflammatory food	CRC	Control	P-value
refined grains	144.80±60.44	155.06±55.55	0.267
fish	1.09 ±.944	1.63 ±1.165	0.202
high-energy beverages	1.34 ±3.227	0.86± 1.203	0.222
tomatoes	1.09± .944	1.63 ±1.165	0.202
red meat	0.69 ±1.138	1.19 ±1.001	0.142
Pizza	0.73 ±2.050	0.97 ±1.837	0.430
snacks	4.19 ±3.376	4.54± 3.920	0.560
processed meat	1.09± .944	1.63± 1.165	0.202
organ meat	3.24 ±2.09	3.67± 2.760	0.275

Table 3. Frequency of consumption of anti-inflammatory foods

Anti-inflammatory food	CRC	Control	P-value
green-leafy vegetables	25.24± 13.34	29.82 ±15.48	0.05
dark-yellow vegetables	13.32± 5.99	12.79± 5.80	0.581
other vegetables	19.45± 9.259	25.60± 11.896	0.000
fruit juices	0.73± 2.050	0.97 ±1.837	0.430
coffee	1.09±0.944	1.63±1.165	0.202
tea	4.19 ±3.376	4.54 ±3.920	0.560

Discussion

Colorectal cancer is a serious health issue in the world and an important cause of cancer deaths. The Globocan database indicates that in the year 2020, there were an estimated 1.15 million new cases of colon cancer (7). Extensive research has been conducted to assess the role of lifestyle factors, with a particular focus on nutrition, in the onset and prevention of CRC. Risk factors linked to CRC are known to include a diet high in fat, the consumption of red and processed meats, obesity, diabetes, smoking, alcohol intake, and insufficient physical activity (8, 9).

Fruits and vegetables may be said to protect against CRC due to the high levels of several potential anti -cancer compounds, including fiber, folate, other vitamins, minerals and antioxidants, but the findings are very contradictory (10, 11). A previous Iranian study including CRC patients, subjects with colorectal adenomatous polyps and controls reported a reverse relationship between inflammatory content of diet with CRC and polyps (12). In the Iowa Women's Health Study, adjusted hazard ratios for rectal and colon cancer based on quintiles of dietary inflammatory index was statistically non-significant (13). In the present study, except for dark-yellow vegetables, patients reported a statistically significant lower consumption of vegetables. A Chinese case-control study revealed the overall consumption of vegetables and fruits has been linked to a reduced risk of colorectal cancer. Interestingly the association was related to the color of fruits/ vegetables and non-significant for green ones (14). In the study of Yuki Sato among Japanese population, risk of colorectal cancer was not associated with intake of fruit and vegetable (15). A noteworthy study examined the impact of fruit and vegetable intake on the risk of developing different types of cancer. When analyzing data from all studies, a protective effect associated with the consumption of both fruits and vegetables was revealed. However, cohort studies revealed no significant association with vegetable intake, neither in all studies nor concerning the colon or rectum cancers (16).

Our observations indicated that there was no different in meat (red, processed and organ) consumption between the individuals in the case group and those in the control group. It has been widely accepted that the intake of dietary meat and/or fat contributes to an increased risk of developing colon cancer. Nitrosamine compounds found in meat have carcinogenic properties responsible for increased risk of CRC (17). A cohort of 6282 CRC subjects, demonstrated that intake of red and processed meat and poultry did not alter the risk of CRC (18). Another cohort study which analyzed Swedish female subjects reported meat as a risk factor for distal colon cancer and no association between consumption of meat and proximal colon or rectum was observed (19). In contrast, several researches indicate that the consumption of meat is a crucial risk factor for the development of colorectal cancers. Data from UK biobank indicates that red and processed meat intake significantly increase CRC risk (20). There is a positive link between red meat consumption and colorectal cancer incidence according to global data analysis (21).

The anatomical location of cancer is one of the issues that can be related to diet. For example, diets low in meat and rich in fiber and vegetables are protective factors for distal colon cancer. Result are also influenced by gender (22).

In summary, our results provide no evidence to support an association between consumption of potentially inflammatory foods such as meat and colorectal cancer. But consuming anti-inflammatory foods like vegetables may help reduce the risk of CRC. The observed contradictions can be due to the role of genetics in the disease and the difference in risk factors in different societies Due to the sample size, we were not able to separate the cancer by location. Also, the case-control design and being single-centered are other limitations. Considering the costs of gastrointestinal cancers on the health

system and society, it is necessary for health policy makers to pay attention to the modification of nutritional styles, as well as conducting prospective longitudinal studies in the country.

Conclusion

The findings suggest that promoting a diet rich in vegetables may contribute to a reduction in the incidence of colorectal cancer.

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Conflicts of interest

The authors declare that the research was conducted in the absence of any potential conflict of interest.

Authors' contributions

All authors participated in the conceptualization and design, analysis and interpretation of the data, drafting of the manuscript, and critically revising it for intellectual content. They have all approved the final version for submission and have agreed to assume accountability for all facets of the work.

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