

# Fruit and Vegetable Consumption in Patients with Gastrointestinal Cancer

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## Abstract

**Introduction:** Low intake of fruits and vegetables (F&V) is associated with gastrointestinal cancers, and cancer-related deaths due to poor nutrition and obesity.

**Objective:** To describe the frequency of F&V consumption in patients with gastrointestinal cancer, investigating the association among consumption of F&V and socio-demographic, nutritional and disease-related variables.

**Methods:** A cross-sectional study was performed in 46 patients with gastrointestinal cancer recruited at the University Hospital of Pelotas, Brazil, between July 2008 and March 2010. F&V consumption was assessed through a Food Frequency Questionnaire and the nutritional status was measured using a Patient-Generated Subjective Global Assessment (PG-SGA) and Body Mass Index. Socio-demographic variables and disease-related information were obtained from standardized questionnaires. The association between frequent consumption of F&V and independent variables was assessed by chi-square tests.

**Results:** The analysis showed that 54.3% of our sample were male subjects, 43.5% were 65 years or older, 67.4% had been diagnosed with colon or rectal cancer and 71.7% were classified as "suspected malnourished" by the PG-SGA. We also found that 82.2% and 56.5% of our sample consumed fruits and vegetables in a daily basis, respectively. A tendency of increase in F&V consumption was observed in older people who ate more than 3 meals a day and lived with a partner. However, these differences were not considered statistically significant.

**Conclusions:** There was no association among fruit and vegetable consumption and socio-demographic, nutritional and disease-related variables.

**Keywords:** Cancer; Food intake; Nutritional assessment

## Introduction

Non-communicable chronic diseases are the major causes of death in many countries, and every year there is an increase in cardiovascular problems, diabetes, obesity and cancer. There are many explanations for the higher occurrence of such morbidities, such as population aging and changes in life style. The adoption of dietary practices considered unhealthy and the association with physical inactivity, alcohol intake and smoking are risk factors that lead to the occurrence of non-communicable chronic diseases [1]. Evidences shows that inherited high susceptibility to cancer accounts for only a small proportion of cases and the majority of adult cancers are caused mainly by environmental factors. This means that most cancers could be preventable if people adopt healthier habits [2]. According to the Brazilian National Cancer Institute (INCA) [3], 25% of deaths by cancer are associated to poor nutrition and obesity, and dietary habits have a direct impact on tumor location.

Gastric cancer (GC) incidence has declined in most countries over the years. However, stomach and colorectal cancers are ranked between the five most frequent cancers worldwide [4]. For 2012, it was estimated 14.067.900 new cases of cancer in the world, and 37.080 new cases of cancer in men and 32.950 new cases in women only in Brazilian Southern region [5,6]. Among these numbers, 2,510 new cases were expected to be male colon and rectal cancers and 2,860 female, for every 100,000 Brazilian inhabitants. Data from the same institution reveal that gastrointestinal cancers are the second type of cancer with the highest incidence in women and the third in men [6].

Fruit and vegetables (F&V) are critical components to maintain a

healthy diet and, when consumed in proper amounts, they can play the role of natural protectors against various diseases, mainly cancer prevention and recovery, avoiding tumors relapse [1,2,7,8]. According to the Global Strategy on Diet, Physical Activity and Health the low intake of F&V is associated with 19% of gastrointestinal cancers and about 2.7 billion deaths can be linked to insufficient intake of these foods [1]. There are several mechanisms through which the protection effects of F&V can act, involving micronutrients and antioxidants, such as flavonoids, carotenoids, vitamin C, folic acid and dietary fibers, which block the action of cancerous substances, avoiding oxidative damage to the cells [7].

Regarding the consumption of these foods, the World Health Organization (WHO) has developed in 2002 a Global Strategy to promote a healthy diet, which recommends 400 g a day of F&V or to five daily portions of these foods [1]. The Dietary Guide (*Guia alimentar*) to the Brazilian population recommends a daily consumption of three

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fruit portions and three vegetable portions, distributed throughout the meals [9].

Despite the fact that the appropriate consumption of F&V is widely recommended by different health agencies in the prevention of chronic-degenerative diseases, particularly gastrointestinal cancers, less than half of the population meet these recommendations. The 2012 Surveillance System for Risk and Protective Factors (Vigitel), which contains information about adults living in Brazilian state capitals, verified that only 22.7% of the subjects have met the F&V intake recommendations [10]. For cancer patients, these recommendations become even more critical, both to maintain the nutritional status as well as to prevent relapses [11].

The consumption of these foods by healthy people is considered insufficient and it is estimated to be even lower among subjects with cancer, since the food intake in these patients is considerably reduced, not only as a result of the disease, but also due to the types of treatment adopted and their respective side effects [11]. It is common among gastric cancer patients to suffer from cachexia, a multifactorial syndrome characterized by a negative protein and energy balance caused by a combination of reduced food intake and abnormal metabolism. Cancer cachexia compromises the quality of life and the response to cancer treatment, increasing morbidity and mortality of cancer patients [12,13].

The aim of the present study is to describe the frequency of F&V consumption in patients with gastrointestinal cancer, investigating the association between the consumption of F&V and socio-demographic, nutritional and disease-related variables.

## Methodology

We conducted a cross-sectional analysis from a cohort study performed from July 2008 to June 2012, in the Chemotherapy Service of the University Hospital in the city of Pelotas, Brazil. The cohort study was conducted with patients diagnosed with gastrointestinal or lung cancer, aged 18 years or older and receiving chemotherapy for the first time. More details about this longitudinal study can be obtained elsewhere [14].

In this cross-sectional analysis, we used data from baseline, which occurred between July 2008 and May 2010. Forty-six patients with gastrointestinal cancer were enrolled and they had started chemotherapy as they had been diagnosed with gastrointestinal cancer. Their nutritional status was assessed through a Patient-Generated Subjective Global Assessment (PG-SGA), using a questionnaire standardized by Gonzalez et al. [15] and the Body Mass Index (BMI). They were weighted on a Filizola digital scale, PL 150 model with 150 kg capacity and 100 g precision, and the height was measured by a mechanical audiometer with 200 cm capacity and 1 mm precision.

F&V consumption frequency was assessed using a Food Frequency Questionnaire adapted from Ribeiro et al. [16] that contains 64 items, from which 11 in the fruit group and 9 in the vegetable group, in relation to the consumption six months before filling out the questionnaire. In our data analysis, F&V consumption was dichotomized into frequent (daily consumption of at least one portion of fruit and vegetables) or infrequent consumption. Data were collected by two nutritionists who were previously trained. Information of gender, age marital status, cancer location, and type of chemotherapy were obtained through standardized questionnaires.

We analyzed the relation between F&V consumption – the

outcome – and the following independent variables: gender (male/female), age (<50 years/50-64 years/>65 years), marital status (have a partner/have no partner), cancer location (esophagus or stomach/colon and rectum/spleen and gallbladder), type of chemotherapy (previous or neoadjuvant/adjuvant/palliative), subjective global assessment (A/B/C), nutritional status by BMI (low weight/eutrophic/overweight/obesity) and meals per day ( $\leq 3$ / $>3$ ).

Data were double entered and the consistency was checked using EpiInfoTM 6.04d software. Data analysis was conducted in Stata 12.0 (Stata Corp., College Station, TX, USA). Socio-demographic characteristics and those related to the disease and the nutritional status were described as mean and standard deviation. A chi-square test was used to assess the association between F&V consumption frequency and all exposure variables. Patients have agreed to participate in the study by signing a Free, Prior and Informed Consent Form. The study protocol has been approved by the Research Ethics Committee of the Federal University of Pelotas (UFPEL) and by the Committee on Ethical Research of the Mercy Hospital in Pelotas. The confidentiality of all information was warranted.

## Results

The majority of the 46 patients assessed was male, under 65 years and reported that they had a partner. Regarding tumor location, most patients were diagnosed with colon or rectal cancer and half of them would undergo palliative chemotherapy. According to the BMI, 63% of the subjects were eutrophic. Nevertheless, according to the PG-SGA, 71.7% of the patients were rated as suspected malnourished or mildly malnourished (Table 1).

Regarding the daily consumption of F&V, it was clear that fruit intake is greater than vegetable intake, since the most of patients have reported that they ate fruit daily (82.6%), while the daily intake of vegetables was reported by a little more than half of the sample (56.5%) (Table 1).

In addition, it was clear that the fruit mostly eaten by all patients is banana (60.9%) and the one less eaten is avocado (2.2%) (Table 2). Among vegetables, tomato is consumed in a daily basis by approximately 35% of the sample, while eggplant was the lowest consumed, since 95.6% of all patients reported they consumed it less than once a month (Table 3).

In the bivariate analysis, we could observe that there was not any difference among F&V consumption and age groups, gender, subjects that resided or not with their partners, patients rated as eutrophic and among those that had 3 meals a day (Table 4).

## Discussion

The present study aimed to describe the frequency of F&V intake in patients with gastrointestinal cancer since the consumption of these kinds of foods can reduce up to 30% the risk of gastrointestinal cancer. We have observed a high frequency of daily fruit intake, while a little more than 50% of the sample have reported daily vegetable intake. We believe that F&V consumption frequency observed among these patients might be influenced by recent changes introduced in their food diet as a result of their diagnosis, not reflecting habits prior to the diagnosis. Thus, the impact of the diagnosis might have caused changes in their recent dietary habits, increasing F&V consumption.

A population study has shown that a minority of Brazilian adults follow recommendations by WHO and the Brazilian Ministry of Health on F&V consumption [17]. A similar study performed with colon-

Characteristics	N	Percentage (%)
Gender		
Male	25	54.3
Female	21	45.7
Age		
< 50 years	10	21.7
50-64 years	16	34.8
≥ 65 years	20	43.5
Marital Status		
Have a partner	26	56.5
Have no partner	20	43.5
Cancer Location		
Esophagus/stomach	11	23.9
Colon and rectus	31	67.4
Spleen and Gallbladder	4	8.7
Type of Chemotherapy		
Previous/ Neoadjuvant	13	28.3
Adjuvant	10	21.7
Palliative	23	50
Subjective Global Assessment		
A	5	10.9
B	33	71.7
C	8	17.4
BMI		
Low weight	3	6.5
Eutrophic	29	63
Overweight	13	28.3
Obesity	1	2.2
Meals/day		
≤ 3	15	32.6
> 3	31	67.4
Daily fruit intake		
yes	38	82.6
no	8	17.4
Daily vegetable intake		
yes	26	56.5
no	20	43.5

**Table 1:** Socio-demographic characteristics associated to the disease and the nutritional status. Pelotas, Brazil, 2014 (N=46).

Fruit	Daily	4-6x/week	1-3x/week	1-3x/month	<1x/month
Orange/Tangerine	19 (41.3)	5 (10.9)	11 (23.9)	3 (6.5)	8 (17.4)
Banana	28 (60.9)	3 (6.5)	9 (19.6)	1 (2.2)	5 (10.9)
Apple/Pear	9 (19.6)	2 (4.4)	25 (54.3)	0 (0.0)	10 (21.7)
Papaya	8 (17.4)	3 (6.5)	13 (28.3)	3 (6.5)	19 (41.3)
Watermelon/ Melon	2 (4.4)	0 (0.0)	14 (30.4)	4 (8.7)	26 (56.5)
Grapes/ Pineapple/Guava	6 (13.0)	1 (2.2)	13 (28.3)	4 (8.7)	22 (47.8)
Avocado	1 (2.2)	0 (0.0)	11 (23.9)	6 (13.0)	28 (60.9)
Mango/Kaki (Persimmon)	4 (8.7)	0 (0.0)	12 (26.1)	9 (19.6)	21 (45.6)
Others	3 (6.5)	0 (0.0)	12 (26.1)	1 (2.2)	30 (65.2)

**Table 2:** Fruit consumption frequency. Pelotas, Brazil, 2014 (N=46).

rectal patients in Brazil showed that only 7.1% and 2.9% of subjects had a daily intake of 2 to 5 portions of fruit and vegetables, respectively [11]. On the other hand, a study held in the Brazilian Federal District [11], with 70 patients with colon-rectal cancer at a postoperative stage, has shown that approximately 64% of the patients ate one to two

portions of fruit daily. In our study, we have found that 82% of the sample reported eats fruit in a daily basis.

Since fruits and vegetables contain some nutrients such as vitamin C and E, folate, carotenoids, and flavonoids, its consumption may develop a favorable effect on cancers risk. A population study performed in Shanghai tried to prove the association between fruit and vegetable consumption and the reduction of gastric cancer risk using a food frequency questionnaire. However, only a reverse association has been found between the consumption of fruit and the reduction of

Vegetable	Daily	4-6x/week	1-3x/week	1-3x/month	<1x/month
Sweet potato/Pumpkin	1 (2.2)	34 (73.9)	0 (0.0)	5 (10.9)	6 (13.0)
Lettuce/Watercress/ Arugula	11 (23.9)	19 (41.3)	5 (10.9)	0 (0.0)	11 (23.9)
Cabbage/Chard/ Cauliflower	1 (2.2)	34 (73.9)	1 (2.2)	3 (6.5)	7 (15.2)
Kale/Broccoli/Spinach	1 (2.2)	30 (65.2)	2 (4.4)	2 (4.4)	11 (23.9)
Carrot	9 (19.6)	23 (50.0)	5 (10.9)	1 (2.2)	8 (17.3)
Tomato	16 (34.8)	17 (36.9)	5 (10.9)	2 (4.4)	6 (13.0)
Eggplant (or Aubergine)	1 (2.2)	1 (2.2)	0 (0.0)	0 (0.0)	44 (95.6)
Beetroot/Green beans/Chayote/Corn/ Zucchini	5 (10.9)	30 (65.2)	3 (6.5)	1 (2.2)	7 (15.2)

**Table 3:** Vegetable consumption frequency. Pelotas, Brazil, 2014 (N=46).

Variables	Fruit consumption n(%)	p-value	Vegetable consumption n(%)	p-value
<b>Gender</b>				
Male	20 (52.6)	0.611	16 (61.5)	0.264
Female	18 (47.4)		10 (38.5)	
<b>Age</b>				
<50 years	8 (21.1)	0.390*	3 (11.5)	0.100*
50-64 years	12 (31.6)		10 (38.5)	
>65 years	18 (47.3)		13 (50)	
<b>Marital Status</b>				
Have a partner	21 (55.3)	0.707	15 (57.7)	0.855
Have no partner	17 (44.7)		11 (42.3)	
<b>Cancer Location</b>				
Esophagus/stomach	8 (21)	0.584*	4 (15.4)	0.609*
Colon and rectus	27 (71.1)		21 (80.8)	
Spleen and Gallbladder	3 (7.9)		1 (3.8)	
<b>Type of Chemotherapy</b>				
Previous/Neoadjuvant	12 (31.6)	0.056*	9 (34.6)	0.210*
Adjuvant	10 (26.3)		6 (23.1)	
Palliative	16 (42.1)		11 (42.3)	
<b>Subjective Global Assessment</b>				
A	5 (13.2)	0.281*	4 (15.4)	0.344*
B	27 (71)		18 (69.2)	
C	6 (15.8)		4 (15.4)	
<b>BMI</b>				
Low weight	2 (5.3)	0.185*	1 (3.9)	0.118*
Eutrophic	23 (60.5)		15 (57.7)	
Overweight	12 (31.6)		9 (34.6)	
Obesity	1 (2.6)		1 (3.9)	
<b>Meals/day</b>				
≤ 3	13 (34.2)	0.613	10 (38.5)	0.334
>3	25 (65.8)		16 (61.5)	

\*p for linear trend

**Table 4:** Fruit and vegetables consumption in relation to socio-demographic variables. Pelotas, Brazil, 2014 (N=46).

gastric cancer risk in Chinese men rated in the lower quartile for fruit consumption [18]. A meta-analysis that aimed to assess the association between consumption of fruits and vegetables and risk of gastric cancer concluded that finds from cohort studies suggest a protective effect only for consumption of fruits [19]. Unfortunately, we were unable to perform a longitudinal analysis to assess the consumption of fruits and vegetables and risk of gastric cancer. Furthermore, due to the sample size we did not have power to find any association to show trends in risk of cancer.

One of the limitations of the present study was the systematization of the results which did not allow the analysis of the number of portions per day. This analysis would allow us to compare the F&V consumption among patients and with the recommendations by the WHO (5 daily portions) and the Brazilian Ministry of Health (3 daily portions of F&V) [8,9]. Furthermore, the reduced sample size contributed to the lack of association among independent variables and F&V consumption. Studies held with larger samples might help to prove these associations. The European Prospective Investigation into Cancer and Nutrition (EPIC) conducted a study with 573 gastric and esophageal cancer patients which found that more variety in vegetable and fruit consumption and fruit consumption alone were associated with a decreased risk of esophageal squamous cell carcinoma. However no strong inverse association between variety in vegetable and/or fruit consumption and gastric and esophageal adenocarcinoma risks was observed [20], Gonzales et al. observed a non-significant inverse association between total fresh fruits (p for trend 0.05) and GC risk [21]. Also, no association was observed for total vegetable intake. In our study, no strong association was found between fruit consumption and type of cancer.

Finally, with regards to the nutritional assessment of the patients, nutritional status rating varied according to the assessment method applied (BMI and PG-SGA). In the present study, 63% of the sample were eutrophic when analyzed by BMI, while according to the PG-SGA only about 11% of the sample were eutrophic (GP-SGA = A). Similar results were found in a prospective follow-up study held with cancer patients registered in the Interdisciplinary Home Care Program in Pelotas, Brazil. The authors found a prevalence wasting syndrome of 43% using the PG-SGA, despite an average BMI of 21 Kg/m<sup>2</sup> [22] in the same sample. These values are similar to the ones found in the present study, showing a considerable difference between the nutritional assessment performed by BMI and that by PG-SGA, also showing that the PG-SGA is possibly a more complete and trustworthy approach to the patient's reality. According to Gonzalez et al. [9], the PG-SGA is a method developed specifically for cancer patients, since it takes into account nutritional impact symptoms present in these patients, thus becoming a more sensitive tool to assess this population.

## Conclusion

We conclude that there was no association among fruit and vegetable consumption and socio-demographic, nutritional and disease-related variables in this sample. However, the study shows a trend to increase consumption in older subjects and in those who had more than three meals a day. However, more studies relating fruit and vegetable consumption and gastrointestinal cancer with appropriate sample size are needed to achieve more clear results. The study of food intake in cancer patients is important because the adoption of appropriate dietary habits is critical for the nutritional management of these patients and for the prevention of disease relapses.

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