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VARIATIONS IN DIETARY HABITS DURING CANCER TREATMENT: RESULTS OF A CROSS-SECTIONAL SURVEY

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SUMMARY – We aimed to explore variations in dietary habits in cancer patients according to clinical and demographic characteristics. We conducted a cross-sectional survey on cancer patients treated with systemic therapy. The survey included 42 items concerning demographic and clinical data, observed dietary modifications and oncologist implication. All patients gave their informed consent to participate in the study. Statistical Package for Social Sciences for Windows software version 20 was used on statistical analysis. The study involved 110 patients (female 71.8% and male 28.2%), mean age 53.4 years. They were treated mostly for breast cancer (58.2%). Patients reduced or stopped taking canned products (70%), milk (59.1%), red meat (80%), processed meat (76.4%), fatty food (88%) and sugar (83.6%). Conversely, preferred food were fish (73.6%), fruits and vegetables (95.5%), and honey (54.5%). Weight loss of 5 kg or more was higher among patients on a sugar restrictive diet (p=0.026). Thirty-five patients discussed diet with their oncologist. Patients received information on diet from the internet and other patients. Our findings suggested that patients were aware of the role of a balanced diet and made many changes. However, most of the patient information was derived from informal sources.

Key words: *Feeding behavior; Neoplasms; Health communication*

Introduction

Cancer is a worldwide health problem, with 18 million cases *per* year, led by breast cancer in females and lung cancer in males in 2018[1]. Despite recent innovations, more than 5 million will die from their malignant disease[1]. Among cancer risk factors, dietary habits are among the most important contributing factors accounting for 35% of them[2-4]. After cancer diagnosis, during treatment and follow-up, diet and nutritional factors play a major role by influencing both the quality and quantity of life[5]. In Tunisia, cancer is a disease of the 20th century with a slight increase during the last 20 years, with presently around 15 000 incident cases, led by breast cancer in females (24.8 to 34 cases/100 000 women/year) and lung cancer in males (17 to 29.4 cases/100 000 men/year), according to Globocan 2018[1]. At diagnosis and during treatment and follow-up, patients and their families have a big concern about dietary recommendations and search for information, correct or fake, on the internet and

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social networks[6]. Cancer patients receive a wide range of advice from many sources[7]. Unfortunately, this advice is often conflicting[8]. In a prospective, observational study conducted at 22 medical oncology centers, 51% of patients had nutritional impairment at the first medical visit[9]. Data suggest that only a minority of oncology care physicians offer guidance regarding healthful lifestyle change. In a study performed among 907 cancer patients, 90% did not receive any information about diet from their health professionals[10].

Our study aimed to explore modifications in dietary habits in Tunisian cancer patients according to their demographic and clinical characteristics, and their impact on body weight, and to assess the role of oncologists in this issue.

Patients and Methods

We conducted a cross-sectional survey *via* an anonymous questionnaire, with adult patients diagnosed and treated for cancer with a systemic therapy, at a medical oncology department. We excluded head and neck, esophageal or gastric cancer patients, and patients presenting a restricted diet due to a metabolic or neurologic disease. After a feasibility phase of 1 month at the day hospital unit, we constructed a questionnaire, initially tested in a pilot study on 15 patients. Patients coming for their systemic treatment responded to the questionnaire that included 42 items. The first part concerned demographic and clinical data (age, gender, educational level, monthly income, and disease site) and dietary modifications. Questions targeted different food types such as canned products, milk, dairy products, red meat, processed meat, fish, fatty food, fast food, sugar, salt, flours, fruits and vegetables, frozen food, honey, and curcuma. We asked patients about using vitamins and alternative treatments. We evaluated the impact on body weight. The second part concerned communication with the oncologist and treating team about diet. All patients gave their informed consent to participate in the study that was approved by the local Ethics Committee.

Statistical Package for Social Sciences (SPSS) for Windows (SPSS Inc., Chicago, IL, USA) software version 20 was used on statistical analysis. All variables including baseline characteristics were expressed as number with percentage for categorical variables, mean ± standard deviation for continuous variables following normal distribution, and median with interquartile range (IQR) for continuous variables not following normal distribution. Normal distribution was tested with the Kolmogorov-Smirnov test. Descriptive analyses were conducted to estimate the prevalence of dietary changes and χ^2-test was used to examine associations between dietary changes and demographics and clinical characteristics.

Results

We approached 156 patients and retained 110 patients that answered all survey questions. Patients were mostly female (n=79, 71.8%) with a mean age of 53.4 years. Concerning education level, 1.8% of the patients were illiterate, 69.1% had a high school level or lower, and 29.1% had university education (Table 1). Tumor sites were breast in 58.2%, lung in 17.3%, and colorectal in 9.1% of cases.

We observed avoiding or reduced consumption of canned products (70%), milk (59.1%), dairy products (57.3%), red meat (80%), processed meat (76.4%), fatty food (88%), fast food (70.9%), sugar (83.6%), salty food (66.4%) and frozen food (62.7%) (Table 2). Conversely, preferred and still consumed food were fish (73.6%), fruits and vegetables (95.5%), and honey (54.5%) (Table 2).

Those who reduced or avoided canned products were more likely those who reduced or avoided red meat (p=0.01) to prefer fruits and vegetables (p=0.05) and fish (p=0.032).

Patients used herbal complementary medicines in 60% of cases (66 patients). Ephedra, black seeds, corossol and linen were the most widely used herbal complementary medicines (Fig. 1).

Patients used vitamins (vitamin C, vitamin D), mineral supplements and ginseng (n=15, 13.6%) and iron supplements (n=5, 4.5%). Some patients experienced fasting while on treatment (11.8%).

Female gender and breast cancer were associated with a reduced consumption of milk (p=0.02 and p=0.042, respectively). Breast cancer patients had a significantly reduced consumption of fast food (p=0.049).

Herbal complementary medicines were preferred by patients younger than 55 years (p=0.03).

Tables 3 and 4 show association between clinical and demographic data and food variations.

Fasting was more practiced by male patients (p=0.01). Fifty-seven (51.8%) patients reported weight loss of more than 5 kg. It was not related to cancer site but was more frequent among patients that adopted a sugar restrictive diet (p=0.026, Fisher exact test).

Concerning information about diet behavior and recommendations, 35 (31.8%) patients discussed with their oncologist and asked for advice about diet and food. Patients who informed oncologist about their habits reduced red meat consumption significantly (p=0.041). Among the 75 patients who did not have advice from their oncologist, 38 (50.7%) patients reported a lack of communication with doctors, 27 (36%) thought that it was useless to talk about nutrition, and ten (13.3%) patients considered that oncologists did not have due knowledge about this subject.

Internet and social network (Facebook) were the main sources of information on diet in 52 (47.3%) patients, followed by family and friends (48 patients, 43.6%), and other patients met at the hospital (43 patients, 39.1%). Female patients were more likely to get information from other patients met at the hospital (p=0.026, Fisher exact test).

Table 1. Demographic and clinical characteristics of study patients

Variable	Number of patients (%)
Gender: female	79 (71.8)
male	21 (29.2)
Age: mean 53.4 (±18.25) years*	
➢ <55	54 (49.1)
➢ >55	56 (50.9)
Educational level:	
➢ illiterate	2 (1.8)
➢ elementary school	24 (21.8)
➢ secondary school	52 (47.3)
➢ university	32 (29.1)
Monthly income:	
➢ under 300 USD	63 (57.3)
➢ more than 300 USD	47 (42.7
Tumor site:	
➢ breast	64 (58.2)
➢ lung	19 (17.8)
➢ colorectal	10 (9.1)
➢ gynecologic	5 (4.5)
➢ others	12 (10.9)

*mean ± standard deviation

Table 2. Food preferences and trends in cancer patients

	Increased consumption n (%)	Same consumption* n (%)	Decreased consumption n (%)	Avoided n (%)	Never consumed n (%)
Canned products (%)	0 (0)	27 (24.5)	52 (47.3)	25 (22.7)	6 (5.5)
Milk (%)	3 (2.7)	35 (31.8)	41 (37.3)	24 (21.8)	7 (6.4)
Dairy products (%)	5 (4.5)	36 (32.7)	44 (40)	19 (17.3)	6 (5.5)
Red meat (%)	2 (1.8)	18 (16.4)	58 (52.7)	30 (27.3)	2 (1.8)
Processed meat (%)	1 (0.9)	15 (13.6)	41 (37.4)	43 (39.1)	10 (9)
Fish (%)	23 (20.9)	58 (52.8)	19 (17.3)	5 (4.5)	5 (4.5)
Fatty food (%)	3 (2.7)	13 (11.8)	51 (46.4)	37 (33.6)	6 (5.5)
Fast food (%)	0 (0)	11 (1)	33 (30)	45 (40.9)	21 (19.1)
Sugar (%)	0 (0)	12 (10.9)	53 (48.2)	39 (35.5)	6 (5.5)
Salty food (%)	0 (0)	34 (30.9)	55 (50)	18 (16.4)	3 (2.7)
Flours (%)	2 (1.8)	51 (46.4)	47 (42.7)	9 (8.2)	1 (0.9)
Fruits and vegetables (%)	39 (35.5)	66 (60)	3 (2.7)	2 (1.8)	0 (0)
Frozen food	1 (0.9)	17 (15.5)	38 (34.5)	31 (28.2)	0 (0)
Honey	25 (22.7)	35 (31.8)	15 (13.6)	14 (12.7)	21 (19.1)

*these patients kept their eating habits unchanged

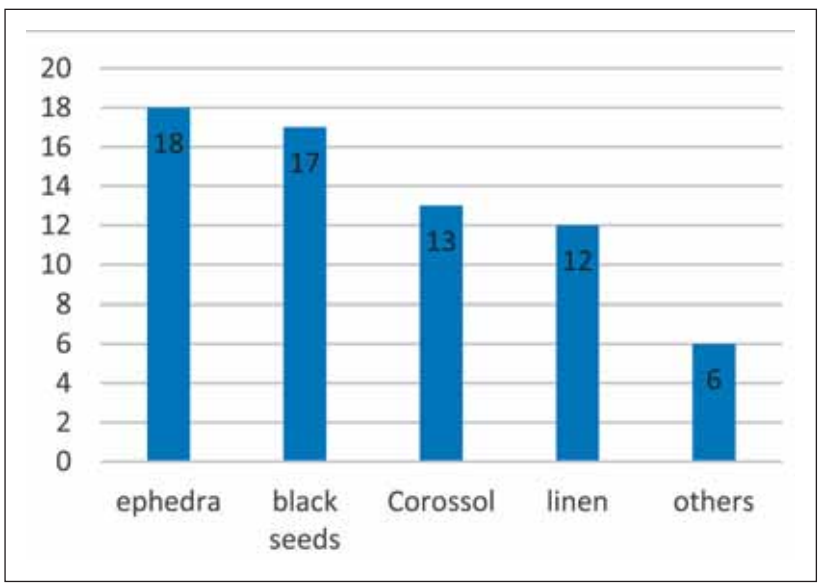

Fig. 1. Use of herbal complementary medicines among cancer patients.

Table 3. Decreased consumption or avoided food according to gender, age and cancer site

	Gender			Age (yrs)			Cancer site			Educational level		
	F	M	p§	<55	>55	p§	Breast	Non breast	p§	University	Lower	p§
Canned products	56	21	0.74	37	40	0.73	47	30	0.35	21	56	0.675
Milk	52	13	**0.02**	32	33	0.97	43	22	**0.042**	19	45	0.73
Dairy products	48	15	0.23	32	31	0.67	40	23	0.19	15	48	0.21
Red meat	65	23	0.34	45	43	0.391	36	52	0.69	24	63	0.69
Processed meat	64	20	0.067	45	39	0.09	52	32	0.155	23	61	0.763
Fatty food	62	26	0.52	42	46	0.56	49	39	0.28	23	65	0.355
Fast food	58	20	0.355	40	38	0.473	28	50	**0.049**	24	54	0.32
Sugar	66	26	0.96	47	45	0.34	53	39	0.78	25	67	0.615
Salty food	50	23	0.276	31	42	0.05	43	30	0.829	18	55	0.213
Frozen food	52	17	0.284	37	32	0.21	45	24	0.05	18	51	0.55

§χ^2-test; p<0.05 was considered statistically significant; F = female; M = male

Table 4. Preferred food according to gender, age, cancer site and educational level

	Gender			Age (yrs)			Cancer site			Educational level		
	F	M	p§	<55	>55	p§	Breast	Non breast	p§	University	Lower	p§
Fish	58	23	0.934	40	41	0.91	47	34	0.95	27	54	0.05
Fruits and vegetables	75	30	0.677	52	53	0.677	60	45	0.311	29	75	0.55
Honey	40	20	0.188	30	30	0.835	32	28	0.25	16	44	0.65
Herbal CM	48	18	0.79	38	28	**0.03**	41	25	0.3	20	46	0.51
Fasting	5	8	**0.01**	6	7	0.82	5	8	0.125	3	10	0.89

§χ^2-test; p<0.05 was considered statistically significant; F = female; M = male; CM = complementary medicine

Discussion

Our cross-sectional study included 110 Tunisian cancer patients surveyed during their systemic therapy and showed significant changes in diet habits. They declared that the reported modifications aimed to go for a 'healthy balanced diet' by reducing specific foods such as dairy products, red meat, processed meat and sugar while preferring others such as fish, fruits, vegetables and honey. Data suggest that healthy dietary patterns are characterized by a preferred diet based on fruits and vegetables with limited quantities of red and processed meat and sugars[11]. In a meta-analysis of seven studies with a total of 124 706 participants, red meat free diet was associated with 18% lower incidence of cancer[12]. In a prospective study in 546 early breast cancer patients[13], consumption of red meat increased the risk of cancer recurrence. In our study, 27.3% of patients gave up red meat intake definitely. However, such a rapid transformation to a vegetarian diet is unlikely to be optimal for cancer patients due to the risk of vitamin B12 deficiency since vitamin B12 is mainly provided by animal products[14]. Vegetal protein seems to be a good alternative to red meat consumption, whereas inconvenience and gastrointestinal upset especially among cancer patients under chemotherapy may discourage vegetal protein consumption[15].

There is a misconception in the public common sense that sugar could increase and favorizes tumor cell growth. However, despite the fact that glucose metabolization is essential for sustaining all mammalian life, the process known as Warburg effect did not have a proven benefit or impact on growth and survival of cancer cells[16]. In our study, 35.5% of patients gave up sugar consumption definitely and we observed that sugar restrictive diet induced a weight loss of more than 5 kilos. In practice, dietary sugars are different and vary, with different structure and metabolization profiles[17]. A meta-analysis involving 13 studies on dietary sugars and pancreatic cancer showed a 22% higher risk of pancreatic cancer related to additional 25 g/day of fructose[18]. Another systematic review analyzed 37 longitudinal studies conducted between 1990 and 2017, evaluating the relation between sugar intake and cancer risk, showed a detrimental association in few of them and only for 'higher sugar beverages'[17]. In cancer patients, low sugar intake can produce a low level of blood sugar, as well as a low level of insulin and insulin growth factor-1 (IGF-1), a sensitive marker of nutritional status that helps maintain muscle mass and protect from oxidative damage. Conversely, a low IGF-1 level may be responsible for body frailty and muscle volume loss[19]. It has also been demonstrated that diets with low sugar and carbohydrate could be associated with a risk of depression, in relation to a decrease in brain production of the serotonin and tryptophan substances that promote the feeling of well-being[20].

In our study, we found a reduced consumption of milk in 59.1% and of dairy products in 57.3% of study subjects. The link between milk and dairy products and cancer is not well established[21]. In a pooled meta-analysis and systematic reviews of 153 studies, 109 (71%) studies showed no evidence for a statistically significant association between dairy consumption and incidence of cancers, 20 (13%) studies showed a decreased risk of cancers with dairy consumption, and 24 (16%) studies showed an increased risk of cancers with dairy consumption[21]. Data suggested an increased risk of some hormone-dependent cancers (such as breast and prostate cancer) with higher dairy consumption. Exogenous estrogens from milk products consumed today may explain the potential increased risk of hormone-dependent cancers[22,23]. Milk and dairy products are highly rich in calcium and D vitamin. Strong evidence indicates that intake or synthesis of vitamin D is associated with a reduced incidence and death rates of colon, breast, prostate and ovarian cancers[24]. In our study, 95.5% of subjects consumed fruits and vegetables, with an increased consumption among patients by 35.5%. Nutritional principles indicate that cancer patients should eat at least moderate amounts of fruits and vegetables. The protective effect of fruits and vegetables comes from some mechanisms such as reducing oxidative DNA damage or increasing the activity of enzymes able to detoxify carcinogen[25]. In a review of 156 studies, persons with low fruit and vegetable intake experienced about twofold risk of cancer compared to those with high intake[26]. The preferred fish intake in our study was 73.7%. The analysis of results of case control studies conducted in northern Italy between 1983 and 1996 concluded that there was a consistent pattern of protection against the risk of oral cavity and pharynx, esophagus, stomach, colon, rectum and pancreas cancers with fish consumption[27]. Patients experienced fasting while in treatment in 11.8% of cases in our study. Recent studies have shown that fasting and cycles of starvation were as effective as chemotherapeutic agents

in delaying progression of different tumors while increasing the effectiveness of many drugs such as cisplatin, doxorubicin, cyclophosphamide, oxaliplatin, sorafenib, mitoxantrone, gemcitabine, etoposide and tyrosine kinase inhibitors in different cancer types[28-32]. On the one hand, in Muslim patients, fasting has a spiritual meaning and is one of the five fundamental pillars of Islam. Through fasting, cancer patients seek strengthening of their relationship with their creator (Allah) since many believe that their disease is a divine test[33]. On the other hand, in our study, we found an important rate of using herbal complementary medicines, which is a common way of coping with cancer[34]. For instance, the black *Nigella sativa* seed was the second most common complementary herbal medicine used by cancer patients in our study (17 patients). It is known to be referred to by Prophet Mohammad as having healing powers[35]. *Ephedra* was the most frequently used complementary medicine in our study. It grows in southern regions of the country, making it available at low prices. Although many patients believe it to be safe, *Ephedra* containing products have been associated with a number of serious adverse effects, including secondary rhabdomyolysis and renal failure, hypertension and stroke[36]. In our study, younger patients were more likely to use complementary medicine. In a Korean study about predictors of complementary medicine use in cancer patients, younger age was an independent predictive factor of use of complementary medicine in multivariate analysis[37].

In our study, patients used vitamins in 13.6% and iron supplements in 4.5% of cases. The analysis of dietary data on 1134 patients enrolled in SWOG S0221[38] found that the use of any antioxidant supplement (vitamins A, C, and E, carotenoids, or coenzyme Q10) both before and during adjuvant treatment was associated with a borderline increased risk of recurrence. Vitamin B12 use both before and during chemotherapy was significantly associated with poorer disease-free survival and overall survival. Use of iron during chemotherapy was significantly associated with recurrence.

Breast cancer patients were associated with a reduced consumption of milk and fast food (p=0.042 and p=0.049, respectively; Fisher exact test). In fact, having breast cancer could be a traumatic experience for women due to its impact on their self-image, and may lead to intense fear from their disease. In a survey on 152 breast cancer patients, the prevalence of anxiety was 32.2%[39]. Breast cancer patients were more likely to seek information from other patients and this could explain the more frequent dietary modification among breast cancer patients. In our study, internet and social network (Facebook) were the major sources of information on diet, followed by family and friends. In fact, cancer patients are likely to encounter a wealth of information in popular media or online, not all of which will be reliable and accurate. There is an abundance of media misreporting dietary factors that are linked to cancer risk, which could be misleading[7]. Recommendations suggest that cancer patients should receive lifestyle counseling[40,41].

A recent survey of oncology health professionals found that only half were aware of dietary guidelines for cancer survivors[42]. According to two studies in United Kingdom patients and American patients, less than half of oncologists routinely discussed lifestyle with their patients[43,44]. In our study, 68.1% of patients had never discussed dietary habits and lifestyle with their oncologist. Discussion with the oncologist seemed to be important in our study since patients who informed their oncologist were more likely to reduce red meat consumption.

Conclusion

In conclusion, our findings suggested that cancer patients were aware of some dietary messages, such as to eat a balanced diet, and report making at least some changes following their cancer diagnosis. The majority of patient information about diet had been obtained from informal sources and only 31.8% of patients discussed the nutritional issue with their oncologist. An oncologist should raise the nutritional subject with cancer patients to allow them access to easy, available, and true information.

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Sažetak

VARIJACIJE U PREHRAMBENIM NAVIKAMA TIJEKOM LIJEČENJA ZBOG KARCINOMA: REZULTATI PRESJEČNOG ISTRAŽIVANJA

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Cilj nam je bio ispitati varijacije u prehrambenim navikama kod bolesnika s karcinomom u odnosu na kliničke i demografske značajke. Proveli smo presječno istraživanje u bolesnika s karcinomom liječenih sistemskom terapijom. Studija je obuhvatila 42 pitanja s demografskim i kliničkim podacima, zabilježenim prehrambenim promjenama te uključenost onkologa. Svi bolesnici dali su svoju obaviještenu privolu za uključenje u istraživanje. Statistička analiza provedena je primjenom programa SPSS for Windows ver. 20. U istraživanje je uključeno 110 bolesnika (71,8% ženskih i 28,2% muških) srednje dobi od 53,4 godine. Oni su uglavnom liječeni zbog raka dojke (58,2%). Bolesnici su smanjili ili prestali uzimati konzervirane proizvode (70%), mlijeko (59,1%), crveno meso (80%), obrađeno meso (76,4%), masnu hranu (88%) i šećer (83,6%). Nasuprot tome, prednost su davali hrani kao što je riba (73,6%), voće i povrće (95,5%) te med (54,5%). Gubitak težine od 5 kg ili više bio je veći među bolesnicima na prehrani sa smanjenim udjelom šećera (p=0,026). O prehrani je sa svojim onkologom razgovaralo 35 bolesnika. Bolesnici su informacije o prehrani dobivali s Interneta te od drugih bolesnika. Naši rezultati ukazuju na to da su bolesnici svjesni uloge uravnotežene prehrane te su mnogo toga promijenili. Međutim, većinu informacija o ovom pitanju bolesnici su dobili iz neformalnih izvora.

Ključne riječi: *Prehrambeno ponašanje; Neoplazme; Zdravstvena komunikacija*