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Research Article

A comparison study of dietary and physical activity habits among cancer patients treated with chemotherapy and radiotherapy

Ayşe Güneş-Bayır^{1*}, Ecem Ortasarı¹ and Mahmut Gümüş²

¹Department of Nutrition and Dietetics, Faculty of Health Sciences, Bezmialem Vakıf University, Istanbul, Turkey

²Faculty of Medicine, Medeniyet University, Istanbul, Turkey

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ABSTRACT

Objective: Cancer is one of the leading causes of morbidity and mortality in the World. At the same time, the number of receiving treatment for cancer cannot be underestimated. Today, the most common therapies in cancer treatment are chemo- and radiotherapy which affect differently the patients' daily life because of their side effects. It is important to minimize these side effects during and after the therapy. Some researches revealed that adequate and balanced nutrition can improve the patients' quality of life whereas the guidelines for cancer recommend highly regular physical activity. Thus, we aimed to compare dietary and physical activity habits in patients receiving two different therapies.

Design, setting, subjects: To collect the data, the questionnaire was used including socio-demographic data, cancer types, anthropometric measurements, dietary and physical activity habits. Sixty-six chemotherapy and 66 radiotherapy patients participated in this study.

Results: Most preferred food groups in chemotherapy patients was "fruits and vegetables" (76%; n = 50) and in radiotherapy patients was "meat, poultry and fish" (71%; n = 47). Median daily water consumption was 1.8 liters in chemotherapy patients and 1.4 liters in radiotherapy patients. Both groups were skipped meals due to lack of appetite. Forty eight percent of chemotherapy patients (n = 32) and 34% radiotherapy patients (n = 23) were being physically active regularly. Just 17 chemotherapy and 10 radiotherapy patients did physical activities every day.

Conclusion: Consequently, the both group of patients may get professional support for physical activity and diet from medical experts

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Introduction

Cancer refers to any one of a large number of diseases characterized by the development of abnormal cells that divide uncontrollably and have the ability to infiltrate and destroy normal body tissue. Cancer cells can spread to other parts of the body through the blood and lymph systems [1, 2]. Today, globally nearly 1 in 6 deaths is due to cancer.

For cancer, a correct diagnosis is essential for adequate, specific and effective treatment regimens which encompasses one or more modalities such as surgery, radiotherapy and chemotherapy [3]. Primary aim of cancer treatment is to increase the survival and quality of life in patients. Most of the chemotherapy or radiotherapy-related toxicities are associated with nutritional problems [4, 5]. During cancer treatment,

patients may affect from side effects of the treatment. A number of changes can be observed in patient's weight, food intake, physical activity status and some gastrointestinal symptoms such as loss of appetite, nausea and vomiting which affect improving malnutrition. Radiotherapy and chemotherapy may cause taste and smell alterations by destroying taste and olfactory receptor cells, creating alterations on the surfaces of cells and receptors as well as interrupting neural coding [6, 7]. American Institute for Cancer Research's (AICR) guideline recommends patients an eating pattern includes plenty of vegetables and fruit, moderate amounts of whole grains and plant protein sources like nuts, beans, lentils, tofu and tempeh along with modest portions of poultry, fish, lean meats and non-fat or low-fat dairy foods to maintain a healthy weight, healing, repair and recovery. Also eating five or six

*Correspondence to: Ayşe Güneş-Bayır, Department of Nutrition and Dietetics, Faculty of Health Sciences, Bezmialem Vakıf University, Silahtarğa Caddesi No: 189, 34065 Eyüp, Istanbul, Turkey; Fax: +90 212 453 18 83; Tel: +90 212 453 17 00 – 4596; E-mail: agunes@bezmialem.edu.tr

smaller meals per day for improve appetite and prevent from unwanted weight loss; avoiding high fat, greasy, spicy or overly sweet foods for managing nausea and vomiting are the other recommendations from AICR [8]. American Cancer Society recommends patients, their principal goal should be to maintain activity as much as possible. Patients receiving chemotherapy and radiotherapy who are already on an exercise program may need temporarily to exercise at a lower intensity and progress at a slower pace and for those who were sedentary before diagnosis, low-intensity activities such as stretching and brief, slow

walks should be adopted and slowly advanced [9].

To our knowledge, no studies have been reported on comparison of dietary and physical activity habits between cancer patients receiving radiotherapy and chemotherapy. Therefore, the aim of this study was to determine and compare dietary and physical activity habits in radiotherapy and chemotherapy patients. In addition, the socio-demographic data, type of cancers and body mass index (BMI) of patients were also included.

Table 1. Patients' characteristics.

	Chemotherapy		Radiotherapy	
	n	%	n	%
Gender				
Female	36	55	32	48
Male	30	45	34	52
Age (years) median (min-max)	54,3 (29-75)		57,9 (31-85)	
Marital Status				
Married	57	86	53	80
Single	9	14	13	20
Employment status				
Unemployed	23	35	24	36
Retired	22	33	15	23
Employee	21	32	27	41
Education				
Basic education	37	56	24	36
High school	21	32	15	23
University degree	8	12	27	41
Living situation				
Villages	3	5	7	11
Town	2	3	3	5
City	5	8	6	9
Metropolitan	56	85	50	76
City				
Istanbul	54	82	54	82
Region				
Marmara	2	3	1	2
Karadeniz	5	8	4	6
Mediterranean	1	2	1	2
Central Anatolia	1	2	2	3
Southeast Anatolia	0		3	5
East Anadolu	0		1	2
Eagean	3	5	0	
Body mass index (BMI) (kg/m2)				
Underweight (≤ 18,5 kg/m2)	4	6	1	2
Normal (18.5-24.9 kg/m2)	23	35	25	38
Overweight (25-29.9 kg/m2)	33	50	22	33
Obese				
Obese Class I (30-34.99 kg/m2)	5	8	11	17
Obese Class II (35-39.99 kg/m2)	1	2	5	8
Obese Class III (≥ 40.00 kg/m2)	0		2	3
Type of cancer				
Hormone-related	25	38	28	42
Lymphoma	0	0	5	8
Brain	0	0	3	5

Lung	12	18	9	14
Head-Neck	4	6	4	6
Gastrointestinal	20	27	15	23
Urinary Bladder	3	5	1	2
Soft Tissue and Bone	2	3	1	2

Materials and methods

This study aimed to compare cancer patients receiving radiotherapy and chemotherapy. Their regular physical activity and pay attention to eating behaviors including dietary habits, meal frequency, and methods for food preparation were investigated. We prospectively hypothesized that patients engaging in any of these fields would have a higher socio-economic status, have higher education, be younger, be non-smokers and non-alcoholic drinkers, have a lower BMI, and participate in regular physical activity.

Participants of the study

A total of 132 cancer patients receiving active radiotherapy and chemotherapy (n = 66 and n = 66, respectively) at the Bezmialem Vakif University Medical Faculty Hospital, Departments of Radiation Oncology and Medical Oncology (Istanbul, Turkey) were asked to complete the questionnaire. The questionnaire made after cancer diagnosis. Socio-demographic data, cancer types, anthropometric measurements, dietary habits and physical activity were asked. Inclusion criteria of the participation in this study were voluntarily, male and female adult participants with ages of 18 and above, aware of their cancer diagnosis and who with no communication problems.

Questionnaire

The survey was self-administered but if requested, help from the attending dietitian was available. Questionnaire has 5 sections: socio-demographic data, type of cancer, anthropometric measurements, dietary habits, and physical activity status. In the first section, socio-demographic data included age, gender, marital status, employment status education level, and living situation. Marital status was described as married and single. Education level was asked to choose as basic education, high school or university degree. Employment status was defined as employed, unemployed and retired. Living situation was asked to choose as village, city, town or metropolitan. In the second section of questionnaire, patients' cancer types were asked. In the third section, anthropometric measurements including weight and height of patients were obtained from the hospital data bank, and so patient BMIs were calculated. According to BMI classification of WHO, patients were grouped into 7 categories: underweight (BMI $\leq$ 18.5 kg/m²), normal weight (BMI 18.5 - 24.9 kg/m²), overweight (BMI 25.0 - 29.9 kg/m²), and obese class I (BMI 30-34.99 kg/m²), obese class II (BMI 35-39.99 kg/m²), obese class III (BMI $\geq$ 40 kg/m²).

In the fourth section, dietary habits were assessed by asking 16 questions : tobacco use, alcohol consumption, meal frequency, existence of skipping meals, if it is yes which meal time, reasons for skipping meals, eating between meals, preferred snacks in between meals, frequency of eating in or out, frequency of consumption of fast foods, preferring the taste of the foods, daily water consumption, salt consumption behavior,

if the participants eat meals salty or not and adding salt to foods without tasting, most frequently used three methods for food preparation, and main intake of different food groups were assessed with multiple-choice items. Also, a 24-hour dietary recall and food frequency were asked.

In the fifth and last section, five questions were asked about patients' physical activity habits. Physical activity was defined as >30 min brisk walking or equivalent once or more a week. The first question was "Do you make physical activity regularly?" and could be answered with "yes" or "no." After that, the continuous questions "If you answer yes, which kind of activity do you prefer?", "How often do you do your activity?", "How long is your activity?", and "How long have you done your activity?" were asked to participants.

Statistical analysis

The statistical software program Statistical Package for the Social Sciences (SPSS) version 16.0 was used for the data analysis. Descriptive statistics were performed to categorize and calculate the distribution and frequency of variables. Numerical variables were presented as means with SDs (mean $\pm$ SD), and median with minimum and maximum values. Nominal variables were calculated in percentages. Statistical analyzes were carried out by non-parametric tests Chi-square test and Kolmogorov-Smirnov test for analyzing the normality, and one-sample T test, chi-square test, and Fisher's exact test for performing comparisons of data from study groups. A p value of less than or equal to 0.05 was regarded as statistically significant.

Results

Characteristics of patients (including socio-demographic data and cancer types) receiving radiotherapy (RT) and chemotherapy (CT) were presented in (Table 1).

In chemotherapy patients, 36 participants were female (55%) and 30 participants were male (45%). Median age was 54.3 years, 86% married (n = 57), 32% employed (n = 23), 33% retired (n = 22), 12% had university degree (n = 8) and 85% living in metropolitan (n = 86) mostly in Istanbul (n = 54). Most of the chemotherapy patients suffered from gastrointestinal system cancers (n = 20). According to BMI calculations, 60% patients were overweight and obese whereas 29% were normal.

In radiotherapy patients, 32 patients were female, and 34 participants were male. Median age was 57.9; 80% married (n = 53), 41% employed (n = 27), 23% retired (n = 15), only 11% had university degree (n = 7) and 78% living in metropolitan (n = 50) mostly in Istanbul (n = 54) such as the chemotherapy group. Most of the radiotherapy patients suffered from hormone related cancers (n = 26). Seventy percent of patients were overweight and obese whereas 29% were normal and only one patient was underweight. Comparison of BMI for both therapy groups was statistically significant (p $\leq$ 0.05) (Figure 1).

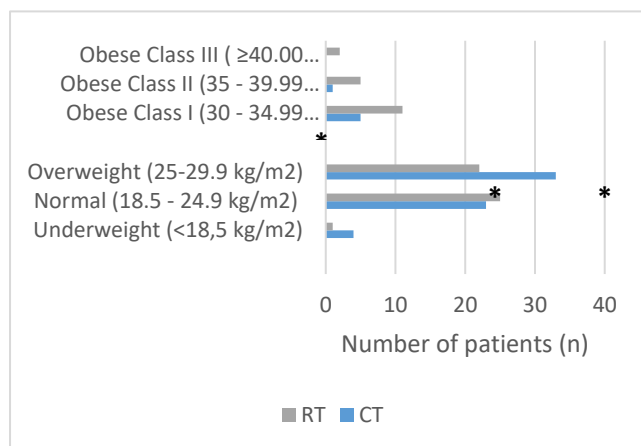


Figure 1. BMI classification of patients participated in this study. * Differences between the both therapy groups were statistically significant ($p \leq 0.05$).

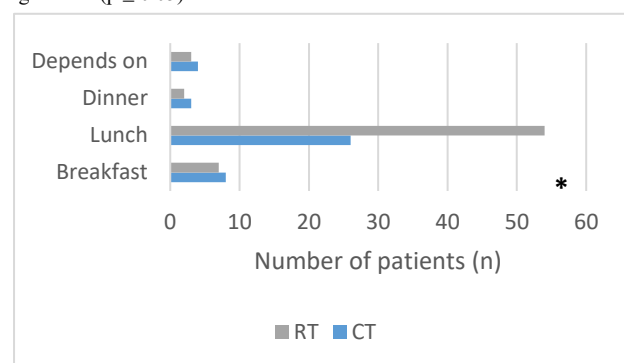


Figure 2. Meal skipping times of patients. * Differences between the both therapy groups were statistically significant ($p \leq 0.05$).

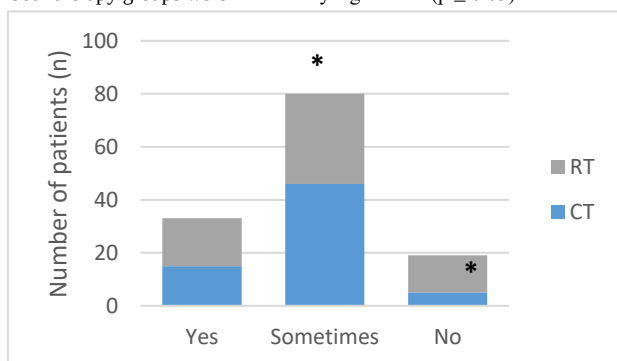


Figure 3. Patients' habit of eating between meals. * Differences between the both therapy groups were statistically significant ($p \leq 0.05$).

Dietary Habits

Meal consuming in patients was differed between 2 - 6 meals and median was 3 meals in radiotherapy patients whereas in chemotherapy patients' median meal consuming was 4. In total of 59% patients answered yes for skipping meal ($n = 41$ in CT, $n = 46$ in RT) (Figure 2). Lunch was the most skipped meal in both groups ($n = 26$ in CT, $n = 54$ in RT) and this difference was statistically significant between the both therapy groups ($p \leq 0.05$). Additionally, "loss of appetite" was the reason for skipping meals ($n = 17$ in CT, $n = 14$ in RT). The second reason was chosen as

"I'm late for..." in CT group ($n = 7$) and in RT ($n = 8$). About asking the eating between meals, both group answered mostly as "yes" ($n = 61$, $n = 52$) in CT and RT groups, respectively. Significant differences were found between the both therapy groups when they answered the question as "sometimes" ($n = 46$ in CT, $n = 34$ in RT) and "no" ($n = 5$ in CT, $n = 14$ in RT) ($p \leq 0.05$). Preferred snacks were asked as multiple choice and the most preferred snacks were fruits ($n = 44$ in CT, $n = 34$ in RT), milk ($n = 31$ in CT, $n = 17$ in RT), nuts ($n = 21$ in CT, $n = 14$ in RT) and cheese ($n = 13$ in CT, $n = 14$ in RT) (Figure 4). Differences between CT and RT were statistically significant ($p \leq 0.05$). In total of 93% of patients had never consumed alcohol ($n = 64$ in CT, $n = 59$ in RT). Only 2 participants consume alcohol everyday ($n = 1$ in CT, $n = 1$ in RT). Five radiotherapy patients continued drinking alcohol despite their gastrointestinal system cancers.

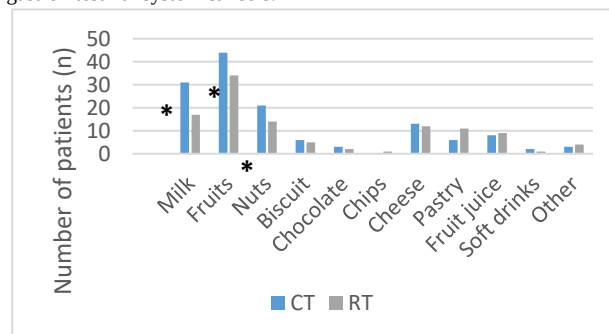


Figure 4. Most preferred snacks of patients. * Differences between the both therapy groups were statistically significant ($p \leq 0.05$).

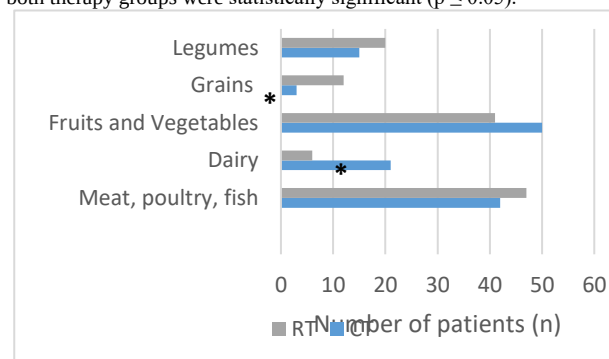


Figure 5. Most preferred food groups of patients. * Differences between the both therapy groups were statistically significant ($p \leq 0.05$).

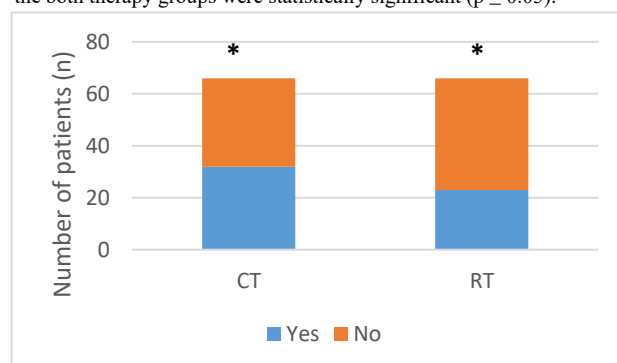


Figure 6. Regular physical activity status of cancer patients. * Differences between the both therapy groups were statistically significant ($p \leq 0.05$).

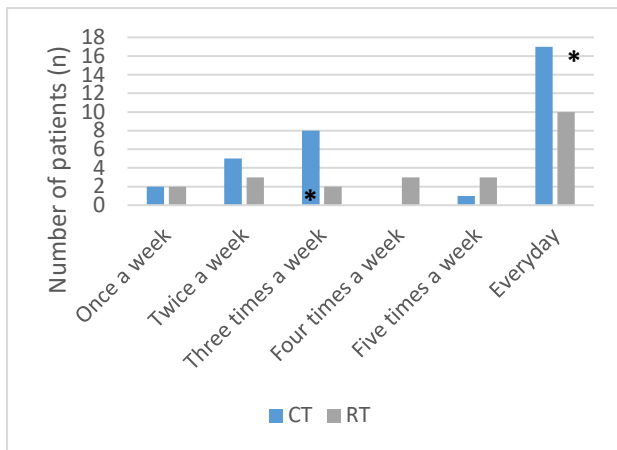


Figure 7. Frequency of physical activity of patients. * Differences between the both therapy groups were statistically significant ($p \leq 0.05$).

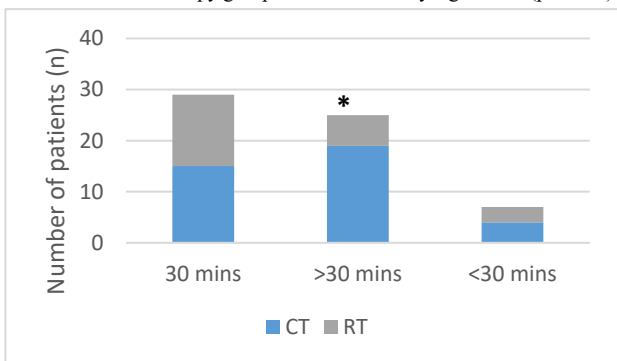


Figure 8. Duration of physical activity. * Differences between the both therapy groups were statistically significant ($p \leq 0.05$).

Seventy six percent of patients had never smoked cigarette ($n = 60$ in CT, $n = 52$ RT) and only 5 patients who receiving radiotherapy were quitted smoking. Two radiotherapy and 1 chemotherapy patients continued smoking despite their lung cancers every day. Another chemotherapy patient with lung cancer, said “I smoke sometimes” about frequency of smoking. Daily water consumption was differed between 0.2 – 4 liters in chemotherapy patients and median was 1.8 liters. In radiotherapy patients, minimum and maximum consuming was 0.2 and 5 liters respectively and median water consumption was 1.4 liters. No statistically difference was found between two therapy groups. The most preferred food groups were asked as multiple choices. In chemotherapy patients, the most preferred food groups were “fruits and vegetables” ($n = 50$), “meat, poultry and fish” ($n = 42$) and “dairy” ($n = 21$) respectively. In radiotherapy patients, the most preferred food groups were “meat, poultry and fish” ($n = 47$), “fruits and vegetables” ($n = 41$) and “legumes” ($n = 20$) (Figure 5). Differences between CT and RT for each food groups were statistically significant ($p \leq 0.05$).

Chemotherapy patients answered the question of “Which taste do you prefer?” as “salty” ($n = 24$), “sweet” ($n = 17$) and “sour” ($n = 15$) and radiotherapy patients answered as “salty” ($n = 25$), “bitter” ($n = 18$) and “sweet” ($n = 13$). No statistically difference was found between two therapy groups. Both groups mostly ate their meals as “less salty” ($n = 45$ in CT, $n = 36$ in RT). In total, 83% of patients didn’t add salt to their meals before they eat ($n = 110$).

“What are the top 3 cooking methods you use the most?” was asked patients and both groups’ answers were similar. The first method was “boiling” ($n = 56$ in CT, $n = 42$ in RT), the second was “baking” ($n = 47$ in CT, $n = 43$ in RT) and the third one was “braising” ($n = 27$ in both CT and RT). No statistically difference was found between two therapy groups.

Patients’ frequency of eating out were asked and 27% of chemotherapy patients answered as “never” ($n = 18$), in radiotherapy patients this ratio was 31% ($n = 21$). Ten percent of chemotherapy patients ($n = 7$) and 13% radiotherapy patients ($n = 9$) were eating out “once a week or more”.

Fifty-six (84%) chemotherapy and 57 (86%) radiotherapy patients reported their frequency of fast-food consumption as “never”. Only 2 chemotherapy patients answered that question as “everyday”.

Physical Activity Habits

Forty-eight percent of chemotherapy patients ($n = 32$) were doing physical activities regularly, on the other hand this ratio was 34% in radiotherapy patients ($n = 23$) (Figure 6) ($p \leq 0.05$). Those 32 chemotherapy patients who said “I am physically active” preferred walking. In radiotherapy patients, 96% preferred walking ($n = 22$) and 4% ($n = 1$) preferred walking/running on the treadmill. Fifty-three percent ($n = 17$) of chemotherapy patients who were physically active, reported that they did physical activities “everyday” (Figure 7). In radiotherapy patients, doing physical activities “everyday” ratio was 43% ($n = 10$). In total, 21% of patients were physically active less than 3 times a week. Significant differences were found between both therapy groups ($p \leq 0.05$). In physically active participants, 88% of chemotherapy patients ($n = 28$) and 87% radiotherapy patients ($n = 20$) reported that they did activities equal or more than 30 minutes (Figure 8). Differences between both therapy groups were significant ($p \leq 0.05$).

Discussion

In this study, dietary and physical activity habits of cancer patients’ receiving two different treatments were compared. According to the World Health Organization data, cancer is the second leading cause of death in the World [3]. Just in Turkey, 49 946 male and 27 022 females died from cancer and cancer deaths accounting for about 20% of the total deaths in 2015 [10]. In our study, we wanted to provide a basis for improve cancer patients’ nutritional pattern and physical activity. World Cancer Research Fund has estimated that between one-fifth and one-fourth of cancers worldwide are related to overweight or obesity, physical inactivity, and/or poor nutrition, and thus could also be prevented [11]. In our study, 29% of the patients were normal and 60% were overweight and obese.

A study with women, who avoid alcohol, BMI ≤ 25 kg/m² at age 18 years and baseline were associated with lower risk of breast cancer [12]. In our study, we obtained same results indirectly; 71% of breast cancer patients who receiving chemotherapy were overweight and one patient (6%) was class-one obese. Only 82% of breast cancer patients receiving radiotherapy were overweight and obese. Unfortunately, two of the obese patients were class-three obese, another two patients were class-

two obese and one patient was class-one obese. In the same study, for colorectal cancer incidence, BMI was strongly associated with lower risk, followed by physical activity and diet. Physical activity was the health behavior the most strongly associated with lower all-cause mortality, followed by BMI and diet, whereas alcohol abstinence showed a positive association. We considered our colorectal cancer patients according to BMI's, 33% of patients which receiving chemotherapy were overweight and 8% patient was class-two obese. One receiving radiotherapy patient was overweight (14%) and 43% patients were class-one obese

WHO's 'Analyzing Research on Cancer Prevention and Survival (July 2016 edition) showed that consuming non-starchy vegetables, fruits, dietary fiber, garlic and being active physically decreases several cancer types [13]. Despite of that, in our study 76% chemotherapy and 62% radiotherapy patients were preferred fruits and vegetables in their diet. On the other hand, many studies have shown that salt and salty foods increase the risk of gastric cancer [14]. In our study, there were 2 gastric cancer patients in chemotherapy group and nine patients in radiotherapy group. One patient in chemotherapy group was preferred salty foods and added salt to foods without tasting but the other patient was preferred less salty foods and didn't add salt to foods without tasting. In radiotherapy patients, 3 patients preferred not salty foods, the other 3 patients preferred less salty foods and one patient preferred salty foods and only one patient added salt to foods without tasting.

ESPEN (The European Society for Clinical Nutrition and Metabolism) Guidelines on Nutrition in Cancer Patients highly recommends that increased level of physical activity in cancer patients for supporting their muscle mass, physical function and metabolic pattern [15]. Evidences showed that physical activity is well-tolerated and safe at different stages of cancer. Generally, cancer patients in our study have reported low levels of physical activity whereas some patients with advanced stages of disease are able and willing to engage physical activity. Moreover, impaired physical activity is one of the causes of systemic inflammation with low muscle mass which is associated with an unfavorable prognosis, increased toxicity of anticancer treatment and reduced quality of life in patients. With physical inactivity, serious adverse effects on muscle mass can be seen followed by cancer treatments. In our study, almost half of the total patients were described themselves as physically active. Being daily physically active is also important, and cancer patients should accept that as a lifestyle. Only 20% patients reported doing physical activity daily. S.Kaasa et al. showed that chemotherapy patients reported significantly better physical performance before the start of treatment than the radiotherapy patients [16]. In our study, same significant results was found.

Patients with head-neck cancer who received radiotherapy, have some side effects that affect nutritional status such as mucositis, taste alteration, dysphagia, xerostomia and related dental decay, difficulties in speech, chewing and swallowing [17-19]. Side effects of radiotherapy can affect daily routine. In a study, participants with breast cancer, after receiving radiotherapy reported some side effects including fatigue, skin reaction, pain and sleeping difficulties [20]. All these side effects of therapies on cancer patients impact our study performing with different ways such as no participation in this study or aggressively during the interview. Nonetheless, to our knowledge, this study is one of the first to

compare dietary and physical activity habits between the cancer patients receiving radio- and chemotherapy in Turkey but there are several limitations. Study include the possibility of answers intended to please (in contrast to entirely anonymous questioning or objective measures), of inaccurate answers for dietary and physical activity status and for self-reported measures (body weight and size). For an exact diet story, a 24-h recall and food frequency should also have carried out. On the other hand, it is still unclear how well the patients participated in this study express the general population of cancer patients. Larger studies in this population needed for reaching better understanding of results and determining the effects of dietary and physical activity habits of cancer patients.

In conclusion, the present study is the most comprehensive examination of self reported eating behaviors including eating habits, regular meal times, frequency of food intake, methods for food preparation, and physical activity with respect to patients' actual status in Turkish cancer patients under radiotherapy and chemotherapy. Additionally, socio-demographic data, type of cancer and BMI were also included. All data were compared between the two therapy groups. According to a report of Canadian Cancer Statistics 2017, the probability of developing a specific type of cancer depends on many factors which are age, sex, risk factors (e.g. smoking, obesity) and life expectancy [21]. In this study, it was found that there were disease-related and worse prognostic factors, and Turkish dietary patterns do not meet most of the diet and cancer prevention guidelines. An implementation of supporting programs about diet and physical activity for patients is necessary in order to offering professional support and practice. Setting of such programs has been planned and will be evaluated after implementation.

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Conflict of interest

None.

Authorship

A.G.B. conceived the research idea and designed the research, performed the statistical analysis; E.O. communicated with patients and collected data; A.G.B., E.O. and M.G. interpreted the results and drafted the manuscript; A.G.B. and E.O. had primary responsibility for the final content. All authors read and approved the final manuscript.

Ethics of human subject participation

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects/patients were approved by the Bezmialem Vakif University Ethical Committee for Clinical Researches (No: 71306642/050-01-04/182). Written informed consent was obtained from all subjects/participants.

REFERENCES

1. Mayo Clinic. (2015) Diseases and Conditions, Cancer Definition.
2. US National Institutes of Health, National Cancer Institute. (2007) Dictionary of cancer terms.
3. World Health Organization. (2017) Cancer fact sheet N°297.
4. Capra S, Ferguson M, Ried K (2001) Cancer: impact of nutrition intervention outcome--nutrition issues for patients. *Nutrition* 17: 769-772. [[Crossref](#)]
5. Mahdavi R, Faramarzi E, Mohammad-Zadeh M, Ghaeemmaghami J, Jabbari MV (2007) Consequences of radiotherapy on nutritional status, dietary intake, serum zinc and copper levels in patients with gastrointestinal tract and head and neck cancer. *Saudi Med J* 28: 435-440. [[Crossref](#)]
6. Altundag A, Cayonu M (2016) Chemical Senses in Cancer Patients. *Curr Pharm Des* 22: 2264-2269. [[Crossref](#)]
7. Lindley C, McCune JS, Thomason TE, Lauder D, Sauls A et al. (1999) Perception of chemotherapy side effects cancer versus noncancer patients. *Cancer pract* 7: 59-65. [[Crossref](#)]
8. Brown JK, Byers T, Doyle C (2003) Nutrition and physical activity during and after cancer treatment: an American Cancer Society guide for informed choices. *CA: a cancer journal for clinicians* 53: 268-291.
9. Doyle C, Kushi LH, Byers T, Courneya KS, Demark-Wahnefried et al. (2006) Nutrition and physical activity during and after cancer treatment: an American Cancer Society guide for informed choices. *CA cancer j Clin* 56: 323-353. [[Crossref](#)]
10. Turkish Ministry of Health. (2015) Cancer statistics.
11. World Cancer Research Fund International. (2014) Cancer preventability estimates for food, nutrition, body fatness, and physical activity.
12. Thomson CA, McCullough ML, Wertheim BC, Chlebowski RT, Martinez ME et al. (2014) Nutrition and physical activity cancer prevention guidelines, cancer risk, and mortality in the women's health initiative. *Cancer Prev Res* 7: 42-53. [[Crossref](#)]
13. World Cancer Research Fund International. (2016) Cancer prevention & survival, summary of global evidence on diet, weight, physical activity & what increases or decreases your risk of cancer.
14. Yassibas E, Arslan P, Yalcin S (2012) Evaluation of dietary and life-style habits of patients with gastric cancer: a case-control study in Turkey. *Asian Pac J Cancer Prev* 13: 2291-2297. [[Crossref](#)]
15. Arends J, Bachmann P, Baracos V, Barthelemy N, Bertz H et al. (2017) ESPEN guidelines on nutrition in cancer patients. *Clin Nutr* 36: 11-48. [[Crossref](#)]
16. Kaasa S, Mastekaasa A, and Thorud E (1988) Toxicity, physical function and everyday activity reported by patients with inoperable non-small cell lung cancer in a randomized trial (chemotherapy versus radiotherapy). *Acta Oncol* 27: 343-349. [[Crossref](#)]
17. Çinkaya A, Umay C, Turkan S (2015) Baş boyun radyoterapisi uygulanan hastalarda glutamin kullanımının yaşam kalitesine etkisi. *Van Med J* 22: 5-9.