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ORIGINAL ARTICLE

Effect of Medical Treatment Methods on Nutritional Status of Oncology Patients

Onkoloji Hastalarına Uygulanan Farklı Tıbbi Tedavi Yöntemlerinin Beslenme Durumu Üzerine Etkisi

Kübra Şahin[1], Gül Kızıltan[2]

[1]Department of Nutrition and Dietetics, İstanbul Kent University Faculty of Health Sciences, İstanbul, Turkey
[2]Department of Nutrition and Dietetics, Başkent University Faculty of Health Sciences, Ankara, Turkey

Abstract

Introduction: The aim of this study is to determine the effect of treatment methods on the nutritional status of oncology patients.

Methods: The study was carried out on 50 (26 men and 24 women) newly diagnosed oncology patients with a mean age of 58±13.50 years. Anthropometric measurements and nutritional status of the patients were evaluated before and after treatments.

Results: The frequent cancer tape in women and men were breast (79.2%) and lung (23.1%) cancer, respectively. The frequency of metastases in patients was 48%, and 32% were Stage IV. Chemotherapy was applied to 24% of patients, chemotherapy and radiotherapy were applied to 12% of patients, chemotherapy with surgery was applied to 42% of patients, and chemotherapy and radiotherapy with surgery were applied to 22% of patients. The mean body mass index of patients before and after treatment was determined as 27.11±4.86 kg/m^2 and 26.61±4.91 kg/m^2, respectively. The majority of patients had a patient-generated subjective global assessment score of 4–8 (moderately malnourished) before (91.7%) and after (83.3%) treatment. While the mean energy intake of female patients was 1127±326.52 kcal before cancer treatment, it was determined as 1104±293.30 kcal after treatment. The energy intake of male patients was 1343±569.3 kcal before cancer treatment and 1166±495.9 kcal after treatment ($p<0.05$).

Discussion and Conclusion: Nutrition support at every stage of the treatment is very important among patients with cancer. Considering the treatment methods, the appropriate nutrition protocol should be applied in the fastest and most effective way according to the condition of each patient.

Keywords: Cancer; Malnutrition; Nutrition; Treatment; PG-SGA

Cancer, which is one of the most important and current problems of modern medicine, is a chronic disease condition that has recovery and exacerbation periods, creates short- and long-term adaptation difficulties, and is widespread in societies. And is tried to be treated with different methods, as a result of the change (muta-

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Correspondence: Kübra Şahin, M.D. İstanbul Kent Üniversitesi Sağlık Bilimleri Fakültesi, Beslenme ve Diyetetik Bölümü, İstanbul, Turkey
E-mail: dytkubrakara@gmail.com **Submitted:** 19.08.2021 **Accepted:** 15.10.2021

tion) of the normal body cell and the rapid proliferation of it without supervision.[1,2]

Cancer is a disease with a low survival, is difficult to treat, and has an increasing prevalence in societies.[3] The International Agency for Research on Cancer detected 19.3 million new cancer cases and 10.0 million cancer-related deaths in 2020.[4]

Among the treatment methods of cancer, medical treatments such as chemotherapy, radiotherapy, and surgery can be used alone or together. Chemotherapy, one of the most commonly used methods in cancer treatments, is a form of treatment using natural, synthetic chemicals, biological agents, and hormones that have selective killer effects, especially against proliferating cells. The main principle of radiotherapy used in cancer treatment is the use of ionizing radiation to destroy cancer cells. There are more than 100 types of cancers that affect the human body.[5,6]

Both the disease itself and the treatments can cause malnutrition in patients with cancer. Patients with cancer have the highest rate of malnutrition compared with patients with other diseases. The development and degree of this disorder are closely related to the patient's response to treatment, quality of life, and survival. Symptoms such as anorexia, weakness, weight loss, fatigue, and early satiety due to the main complications caused by cancer treatments are the reasons that reduce food consumption. Pre-determination of patients at risk of malnutrition provides relief from complaints. Timely intervention improves the quality of life of patients and has a positive effect on their response to the treatments.[7,8]

Malnutrition negatively affects quality of life and treatment toxicities. It is a common problem in cancer patients and is the most important consequence of both the presence of tumor and medical and surgical anticancer treatments.[9] It is estimated that >50% and 30% of inpatient and outpatient patients with cancer, respectively, were malnourished, and 10%–20% of them died due to malnutrition rather than cancer.[9,10] The "Clinical Nutrition in Cancer" guideline of the European Society for Clinical Nutrition and Metabolism recommends regularly monitoring and evaluating the nutritional intake, weight change, and body mass index (BMI) of patients with cancer in order to detect malnutrition early.[9]

In this study, we aim to investigate the effects of various cancer treatment methods on the nutritional status of oncology patients.

Materials and Methods

Patients

This study was conducted on 50 newly diagnosed oncology outpatients (26 men and 24 women), aged 20 years and older, who were admitted to the Oncology Department of Ankara Söğütözü Bayındır Hospital Hospital between July 1, 2014 and October 1, 2014. The beginning of the treatment refers to the period in which the patients applied to the oncology clinic and received a new diagnosis, whereas the end of the treatment refers to the duration of the treatment protocol determined by the oncologist.

This study was approved by the Başkent University Clinical Research Ethics Committee (No: KA14 / 178, dated 11.06.2014), and written informed consent were obtained from all participants.

Data obtained from patient files and follow-up (patients' demographic characteristics and information about their disease, anthropometric measurements, and biochemical parameters) were recorded in the questionnaire form during the treatment process of the patients. The questionnaire form was filled by the researcher using face-to-face interviews with the patients.

Anthropometric Measurements

Anthropometric measurements include height, body weight, and BMI. Body weight was measured using a calibrated electronic scale on an empty stomach, with thin clothes and without shoes. Height was measured using a stadiometer without shoes, with the feet side by side, the back touching the wall, and the head in the Frankfort plane. These measurements were recorded in a questionnaire that was measured twice at the beginning and at the end of the treatment. The height and body weight of the patients were measured using an electronic scale at the beginning and end of the treatment. BMI was calculated by dividing the body weight by the square meter of height [body weight (kg)/(height)^2] and evaluated according to the BMI classification of the World Health Organization.[11,12] BMI is a widely used practical method and is used in the evaluation of protein–energy malnutrition or obesity.[13,14]

Nutritional Status

The nutritional status of the patients was evaluated via two tools: patient-generated subjective global assessment (PG-SGA) and nonconsecutive three-day 24-h food recall. The patients recorded three consecutive days (two during the weekdays and one in the weekend) of food consumption before and after treatment.

Table 1. Distribution of the sociodemographic characteristics of patients

Parameters	Women (n=24)		Men (n=26)		Total (n=50)	
	n	%	n	%	n	%
Age, year (Mean± SD)	59.62±11.51		58.19±15.33		58±13.50	
Age group						
19–29	–	–	2	7.7	2	4.0
30–39	1	4.2	2	7.7	3	6.0
40–49	1	4.2	1	3.8	2	4.0
50–59	12	50.0	7	27.0	19	38.0
≥60	10	41.6	14	53.8	24	48.0
Working status						
Not working	15	62.5	1	3.8	16	32.0
Working	9	37.5	25	96.2	34	68.0
Education status						
Primary school	5	20.8	5	19.2	10	20.0
Middle school	5	20.8	2	7.7	7	14.0
High school	8	33.3	8	30.8	16	32.0
University	6	25.0	11	42.3	17	34.0

SD: Standard deviation.

PG-SGA

The nutritional status of patients was assessed using PG-SGA. The PG-SGA is divided into two sections: the first section includes weight history, changes of food, gastrointestinal symptoms (e.g., nausea, vomiting, and diarrhea), and functional capacity; the second section includes information on physical assessment, metabolic demand, and decision regarding disease-related nutrient demands. Unlike the subjective global assessment (SGA), PG-SGA is a categorical and continuous measurement. A higher score increases the risk of malnutrition. On the basis of the score, the patients can be classified into four global assessment categories: well-nourished (PG-SGA score, 0–1), suspected of being malnourished (PG-SGA score, 2–3); moderately malnourished (PG-SGA score, 4–8); and severely malnourished (PG-SGA score, ≥9).[15]

3-Day 24-h Food Record

At the beginning and end of the treatment, the 3-day and 24-hour food record of the patients were taken. Energy and nutrients were analyzed in the Computer Aided Nutrition Program, Nutrition Information System program developed for Turkey, and the consumed energy and nutrients were calculated.

Statistical Analysis

The data obtained as a result of the research were evaluated using SPSS for Windows Version 21.0 (IBM New York, ABD) Statistical package program. Appropriate descriptive values are given for qualitative and quantitative variables. Numerical variables are shown using mean±standard deviation and bottom–top, while categorical variables are shown using number (n) and percentage (%). Parametric test assumptions (normality and homogeneity of variances) were checked before comparing the groups in terms of numerical variables. The homogeneity of the variances of the compared groups was examined using the Levene test. "Wilcoxon t Test" was used for data that did not show normal distribution of variables. Whether there is a difference between the two independent groups in terms of numerical variables was investigated using t-test in independent groups if parametric test assumptions were met. In case the parametric test assumptions were not provided, the Mann–Whitney U test was used for intergroup comparisons. Whether there was a difference between the groups in terms of categorical variables was examined using the chi-square test. The significance level was taken as $p<0.05$ in all statistical tests.

Results

The patients' mean age was 58±13.50 years (59.62±11.51 years for women and 58.19±15.33 years for men). It was determined that 68% of the patients were working. It was found that 33.3% of the women finished high school, and 42.0% of the men finished college/university (Table 1).

Before treatment, the mean body weight of the female and male patients was 73.85±14.10 kg and 27±12.16 kg, respectively. After treatment, the mean body weight of the female and male patients decreased to 72.91±13.89 kg and

Table 2. The mean body weight and BMI and BMI distributions of the patients before and after the treatment

Anthropometric Measurements	Women (n=24) Mean±SD (Min–Max)	Men (n=26) Mean±SD (Min–Max)
Body weight (before treatment), kg	73.85±14.10 (50.00–106.00)	74.27±12.16 (56.70–103.50)
Body weight (after treatment), kg	72.91±13.89 (52.00–106.00)	72.36±12.55 (55.00–103.30)
p-value	**0.0120**	**0.003**
BMI (before treatment), kg/m^2	28.99±5.14 (18.59–40.00)	25.36±3.93 (17.50–33.70)
BMI (after treatment), kg/m^2	28.60±4.95 (19.13–37.46)	24.78±4.18 (16.60–35.30)
p-value	**0.780**	**0.046**
	n (%)	**n (%)**
BMI classifications (before treatment), kg/m^2		
<18.5 underweight	–	1 (3.8)
18.5–24.9 normal	3 (12.5)	11 (42.3)
25.0–29.9 overweight	11 (45.8)	12 (46.1)
30.0–34.9 1st degree obese	7 (29.2)	2 (7.7)
35.0–39.9 2nd degree obese	2 (8.3)	–
≥40.0 morbid obese	1 (4.2)	–
BMI classifications (after treatment), kg/m^2		
<18.5 underweight	–	3 (11.5)
18.5–24.9 normal	6 (25.0)	9 (34.6)
25.0–29.9 overweight	8 (33.3)	13 (50.0)
30.0–34.9 1st degree obese	7 (29.2)	–
35.0–39.9 2nd degree obese	3 (12.5)	1 (3.8)
≥40.0 morbid obese	–	2 (7.7)

SD: Standard deviation; Min: Minimum; Max: Maximum; BMI: Body Mass Index.

72.36±12.55 kg, respectively (p<0.05). The mean BMI was 28.99±5.14 kg/m^2 in women and 25.36±3.93 kg/m^2 in men before treatment and decreased after treatment, and this difference was statistically significant in men (p<0.05) (Table 2). According to BMI classifications, it was found that 3.8% of the male patients were weak, 43.3% were normal, 46.1% were slightly obese, and 7.7% were first degree obese; 12.5% of the female patients were normal, 45.8% were slightly obese, 29.2% were first degree obese, 8.3% are second degree obese, and 4.2% were found to be morbidly obese. When the BMI distribution of the patients after the treatment is examined, 11.5% of the male patients were weak, 34.6% were normal, 50% are slightly obese, 3.8% are second degree obese, and 7.7% were morbidly obese; 25% of the female patients were normal, 33.3% were slightly obese, 29.2% were first degree obese, and 12.5% were II. was determined to be extremely fat.

When the patients' appetite status was examined at the beginning of the treatment after diagnosis; 7.7% of male patients had a bad appetite, 57.7% moderate, and 34.6% as good/very good. Considering the appetite scale of the patients at the end of the treatment; 15.4% of the male patients had a very bad appetite, 26.9% bad, 19.2% moderate, and 38.5% good/very good. Complications were detected on the first day of treatment after the diagnosis; decreased appetite was found in 34.6% of male patients and 19.2% had increased appetite (data not shown).

The distribution of the patients according to the cancer diagnosis status, cancer type, cancer cell metastasis, cancer stage, operation status, treatment types, and complications are shown in Table 3. The most common cancer type was breast cancer (79.2%) in women and lung cancer (23.1%) in men (p<0.05). The percentages of the patients with metastasis were 25% in women and 75% in men. It was determined that 41.6% of women were in the second stage and 34.7% of the men were in the fourth stage. It was determined that 79.2% of the women and 50% of the men underwent surgery (p<0.05). Chemotherapy with surgery was found to be the most common treatment among patients.

The distribution of the appetite status and complications of patients according to the type of treatment is shown in Table 4. The most common complications in patients were determined as abdominal gas (44%), constipation (36%), and decreased appetite (30%). There were no statistically significant differences between treatment types and complications (p>0.05).

Table 3. Distribution of patients according to cancer diagnosis status by cancer type, cancer cell metastasis, cancer stage, operation status, and treatment types

Information on cancer disease	Women (n=24)		Men (n=26)		Total (n=50)		p
	n	%	n	%	n	%	
Cancer age (Mean±SD)	58.58±11.49		57.96±15.41		58.26±13.53		0.466
Type of cancer							0.000*
Breast	19	79.2	–	–	19	38.0	
Lungs	–	–	6	23.1	6	12.0	
Colon	2	8.2	3	11.5	5	10.0	
Pancreas	1	4.2	3	11.5	4	8.0	
Stomach	–	–	4	15.4	4	8.0	
Liver	–	–	1	3.8	1	2.0	
Bladder	1	4.2	2	7.7	3	6.0	
Testis	–	–	4	15.4	4	8.0	
Larynx	–	–	2	7.7.	2	4.0	
Esophagus	1	4.2	–	–	1	2.0	
Prostate	–	–	1	3.9	1	2.0	
Metastasis							0.877
Yes	6	25.0	18	69.2	24	48.0	
No	18	75.0	8	30.8	26	52.0	
Cancer stage							0.368
I	4	16.7	7		11		
II	10	41.6	5		15		
III	3	12.5	5		8		
IV	7	29.2	9		16		
Operation status							0.032*
Yes	19	79.2	13	50.0	32		
No	5	20.8	13	50.0	18		
Type of treatment							0.116
Chemotherapy	3	12.5	9	34.6	12	24.0	
Radiotherapy	–	–	–	–	–	–	
Chemotherapy and radiotherapy	2	8.3	4	15.4	6	12.0	
Chemotherapy with surgery	11	45.9	10	38.5	21	42.0	
Radiotherapy with surgery	–	–	–	–	–	–	
Chemotherapy and radiotherapy with surgery	8	33.3	3	11.5	11	22.0	

*: P<0.05; SD: Standard deviation.

The distribution of PG-SGA scores before and after treatment is shown in Table 5. At the beginning of the treatment, the PG-SGA scores were statistically significant among treatment groups (p<0.05).

The mean daily energy and macronutrient dietary intake of the patients before and after treatment is shown in Table 6. The mean energy intake of women before treatment was 1127±780 kcal and 1104±520 kcal after treatment (p>0.05). The mean energy intake of men before treatment was 1343±950 kcal and 1166±720 kcal after treatment (p<0.05). It was determined that the percentage of the daily intake of energy from protein and fat, the amount of protein taken per body weight decreased after treatment, the percentage of carbohydrates from energy increased, and the change in the percentage of energy, energy from fats and carbohydrates were found to be statistically significant in men (p<0.05).

Discussion

The first step in correcting malnutrition in patients with cancer is to determine their nutritional status. Anthropometric measurements provide information about malnutrition. No single test is sufficient to determine the type and degree of malnutrition; thus, the patient's dietary anamne-

Table 4. Distribution of complications according to the treatment methods applied to the patients

Complications*	CT		RT		CT and RT		CT with surgery		RT with surgery		CT and RT with surgery		p
	n	%	n	%	n	%	n	%	n	%	n	%	
Decreased appetite	6	50.0	–	–	2	33.3	5	23.8	–	–	2	18.2	
Increased appetite	–	–	–	–	2	33.3	5	23.8	–	–	2	18.2	
Nausea	4	33.3	–	–	1	16.7	2	9.5	–	–	1	9.1	
Vomiting	–	–	–	–	–	–	–	–	–	–	–	–	
Abdominal gas	5	41.7	–	–	3	50.0	9	42.8	–	–	5	45.5	0.871
Smell	2	16.7	–	–	1	16.7	2	9.5	–	–	–	–	
Swallowing problem	3	25.0	–	–	2	33.3	6	28.6	–	–	1	9.1	
Diarrhea	1	8.3	–	–	–	–	2	9.5	–	–	1	9.1	
Constipation	4	33.3	–	–	1	16.7	11	55.0	–	–	2	18.2	

*: Multiple response; CT: Chemotherapy; RT: Radiotherapy.

Table 5. Distribution of PG-SGA scores at the beginning and end of the treatment of patients

PG-SGA Scores	2–3 (malnourished)	4–8 (moderately malnourished)	p
	n (%)	n (%)	
Before treatment			
CT	1 (8.3)	11 (91.7)	0.048*
RT	–	–	
CT and RT	3 (50.0)	3 (50.0)	
CT with surgery	8 (38.1)	13 (61.9)	
RT with surgery	–	–	
CT and RT with surgery	7 (63.6)	4 (36.4)	
After treatment			
CT	2 (16.7)	10 (83.3)	0.057
RT	–	–	
CT and RT	5 (83.3)	1 (16.7)	
CT with surgery	10 (47.6)	11 (52.4)	
RT with surgery	–	–	
CT and RT with surgery	5 (45.5)	6 (54.5)	

*: P<0.05; CT: Chemotherapy; RT: Radiotherapy.

Table 6. Patients' mean intake of energy and nutrients before and after the treatment

Energy and nutrient	Before treatment Mean	After treatment Mean	p
Women			
Energy, kcal	1127±780	1104±520	0.753
Energy, kcal/kg	15.6±2.47	11.5±2.42	0.841
Carbohydrate, %TE	37.2±7.71	39.5±6.27	0.217
Protein, %TE	16.7±4.01	16.1±2.06	0.270
Protein, g/kg	1.95±0.57	1.87±0.65	0.118
Fat, %TE	45.1±7.65	43.5±6.57	0.301
Men			
Energy, kcal	1343±950	1166±720	0.005*
Energy, kcal/kg	18.2±3.86	16.0±2.48	0.006*
Carbohydrate, %TE	41.6±7.73	44.8±5.46	0.015*
Protein, %TE	15.8±2.63	15.3±1.45	0.195
Protein, g/kg	2.16±0.67	1.84±0.64	0.000*
Fat, %TE	41.5±6.76	38.8±5.55	0.032*

*: P<0.05; TE: Total energy.

sis, physical examination, and laboratory tests should be evaluated together. In determining the degree of malnutrition, BMI values and serum albumin levels are the first two tests that can be performed quickly and practically.[16,17]

Karthaus et al.[18] reported an 80% prevalence of malnutrition in patients with colorectal cancer and attributed its causes to longer hospital stays and increased chemotherapy complications. In another study, the prevalence of malnutrition was evaluated using SGA in 234 patients with colorectal cancer, and the frequency of malnutrition was found to be 51%.[19] In another study, it was reported that the incidence of malnutrition in patients with cancer was 29.8%, and this increased to 38.3% during treatment.[20] The PG-SGA is also an important assessment tool that allows the determination of barriers that cause weight loss and food intake and the assessment of the nutritional status, especially in patients with cancer.[21] In this study, it was determined that the majority of patients had a score of 4–8 (moderately malnourished) before (91.7%) and after (83.3%) treatment.

Frequent and easily evaluated BMI monitoring reveals body weight loss.[22] In 40% of oncology patients, weight loss due to nutritional deficiency develops during diagnosis and treatment. If the value of the body weight loss is over

1%–2% in 1 week, 5% in 1 month, or 1%5 in 6 months, it is considered as serious weight loss.[23,24] In a study conducted by Vigano et al.,[25] it was stated that oncology patients lost more than 8.1 kg of body weight in 6 weeks. In a study performed by Çölbay et al.[26] with oncology patients, it was determined that patients lost 2.37 kg of body weight between before and after treatment. In this study, it was determined that the patients lost 1.44 kg body weight at the end of the treatment. In a study conducted with oncology patients, the mean BMI value of the patients before treatment was 24.69 kg/m^2, whereas it was found to be 23.77 kg/m^2 at the end of the treatment.[27] In this study, a significant mean BMI decrease was found in men after treatment ($p<0.05$). In a study, it was determined that 26.5% of patients with cancer had a BMI over 25 kg/m^2 at the beginning of treatment, whereas 2.9% had a BMI below 18.5 kg/m^2.[28] In this study, before treatment, 70% of patients with cancer had a BMI≥25 kg/m^2, and 2.0% of them had BMI<18.5 kg/m^2. After treatment. 68% of the patients had BMI≥25 kg/m^2, and 6% of them 18.5 had BMI<18.5 kg/m^2. While male patients expressing their appetite as "good/very good" were 34.6% at the beginning of the treatment, it increased to 38.5% at the end of the treatment. In addition, when the increase in appetite is questioned among the complications of cancer, 19.2% of the patients state that their appetite has increased. Although there was a decrease in body weight and BMI distributions from the beginning of the treatment to the end of the treatment, when the BMI distributions of the male patients were examined, it was seen that the individuals who were slightly obese and were first degree obese at the beginning of the treatment became second degree and third degree obese at the end of the treatment.

Resting energy expenditure is increased in patients with cancer, whereas food intake is reduced. As a result of decreased protein intake, skeletal muscle is destroyed and amino acids are produced. Normal physiological response to decreased energy intake is a decrease in metabolic rate and energy generation. Cancer patient loses their energy stores as they cannot make this metabolic adaptation.[29] Cancer cachexia is a metabolic syndrome that affects 50-80% of all cancer patients and is a loss of body weight due to the loss of skeletal muscle and adipose tissue. Chemotherapy is also known to cause cachexia and also increase the toxic side effects of chemotherapy.[30]

The decrease in the food consumption of oncology patients should be noticed and intervened early.[31] According to ESPEN's Clinical Nutrition Guide in Cancer, the energy and protein intake recommendations for patients with cancer should be 25–30 kcal/kg/day and 1–1.5 g/kg/day, respectively.[9] In this study, the mean energy and protein intakes of the patients from the 3-day food records were below the recommendations in both gender and periods. Also, the decrease in energy and protein intake were found to be statistically significant in men ($p<0.05$). It was also determined that the percentage of total energy from protein and fat decreased after the treatment compared with that before treatment, and the percentage of carbohydrates from energy increased. The changes in the percentage of energy from fats and carbohydrates were found to be statistically significant in men ($p<0.05$). In recent reviews and observational studies, it has been shown that diet and food selection can be effective in cancer progression, recurrence risk, and overall survival.[32,33]

In conclusion, at every stage of the treatment in patients with cancer, nutritional support is very important. With an adequate nutritional treatment, a decrease in wound healing, anorexia, nausea-vomiting, infection, and fatigue can be achieved. Therefore, the nutritional status of the patients should be determined using the appetite scale, PG-SGA, body weight, BMI, and food records and nutritional support treatment should be performed in accordance with the patient's condition.

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