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ORIGINAL ARTICLE

Evaluation of preoperative nutritional status of patients with gastrointestinal cancer using different nutritional screening tests

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Abstract

Background & Aims: To determine the nutritional status of gastrointestinal cancer patients with two different nutritional screening tools and compare the tools.

Methods: This study was held in 110 patients (female; 41.8% male: 58.2%), aged 19-65 years, admitted to hospital, diagnosed with gastrointestinal system cancer (not operated). The objective was to determine the nutritional status of the patients with nutrition screening tools (Subjective Global Assessment-SGA, Nutritional Risk Screening-NRS 2002), compare the tools, and describe the malnutrition status of patients. Socio-demographic characteristics, anthropometric measurements, biochemical parameters and 24- hour dietary recalls, frequency of foods consumed were determined.

Results: Out of total, 54.7% of males and 56.5% of females had normal Body Mass Index-BMI. Using SGA, 49.1% of the patients had serious, 41.8% had moderate degree of malnutrition. According to NRS-2002, percent-ages of severely, moderately and mildly undernourished patients were 54.6%, 33.6% and 11.8%, respectively. The percentage of patients meeting the recommended Daily allowances was 47.2% and 58.1%, respectively for males and females. According to NRS and SGA tools, statistically significant differences with current weight, ideal body weight, usual body weight, percentage of weight loss, body mass index (BMI), mid-upper arm circumference (MUAC), triceps skinfold thickness (TST), mid-upper arm muscle area, mid-upper arm muscle circumference and mid-upper arm fat area ($p<0.05$) were found. Nutritional status of patients with SGA and NRS tests showed consistent similarity ($\kappa=0.671$, $p<0.001$).Similar changes were found between SGA and NRS scores. Consistency was found statistically significant ($r=0.786$ and $p=<0.001$).

Conclusion: One of the malnutrition screening tools could be preoperatively applied in gastrointestinal system cancer patients. Nutritional support should be planned and administered, when needed.

Keywords: Gastrointestinal system cancers, NRS-2002, nutritional status, screening tools, SGA

1. Introduction

Cancer is a pathological condition manifested by the uncontrolled and rapid division of cells in the body. The general characteristics of cancer cells are high growth rate, spreading to surrounding tissues, and distant metastasis through blood and lymph vessels(1). According to the World Health Organization (WHO) 2018 global data, cancer burden estimates were reported 18.1 million new cases and 9.6 million cancer-related deaths(1, 2).

The mechanisms underlying how a normal cell differentiates into a cancer cell are still unclear. When the factors that contribute to the onset of cancer are examined comprehensively, it is seen that genetic factors constitute only 5% of tumors whereas 95% originate from environmental factors including basic lifestyle, external stimuli and diet (3). Approximately 1/3 of all cancer cases are caused by dietary intake and 1/3 of all cancer-related deaths are associated with nutrition (4). High body mass index, inadequate fruit and vegetable consumption, inadequate physical activity, smoking and alcohol use can be counted as the primary factors in this relationship (5). Therefore, adequate and balanced nutrition, sufficient physical activity, limited or no alcohol use and smoking are the things that are recommended to reduce cancer risk (4). As for cooking methods , frying leads to harmful molecules and free radicals forming in foods, cooking on barbecue and fire lead to formation of carcinogens, and nitrates and nitrites used in processed meat products can lead to cancer development by damaging healthy cell structures in the body and disrupting the DNA structure(5). In addition, with the inadequate consumption of antioxidant nutrients, defense systems of healthy cells against free radicals are weakened, thereby increasing cellular damage. For this reason, protection from cancer with healthy and balanced nutritional habits throughout life has great importance (5).

Malnutrition is a common multifactorial problem in patients with gastrointestinal cancer and mortality and morbidity rates are highly associated with this condition. Biochemical and immunological abnormalities can be corrected with the determination of preoperative nutritional status and necessary intervention(6). Determining malnutrition at the time of diagnosis and initiating early nutrition intervention in the preoperative period has been emphasized in most recent guidelines (7). The first step in detecting malnutrition is performing routine screening methods(8, 9). Fast, simple and reliable screening tools are used to evaluate the nutritional status of cancer patients in particular (9). Subjective Global Assessment (SGA) is one of the screening methods recommended by the "American Society for Parenteral and Enteral Nutrition (ASPEN)" (10). In addition, Nutritional Risk Screening 2002 (NRS-2002), which is recommended by the "European Society for Parenteral and Enteral Nutrition (ESPEN)" is also widely used (11). Along with screening methods, patient history, anthropometric measurements, and biochemical parameters help determine nutritional status(12, 13). In patients with gastrointestinal cancer whose malnutrition is detected by these screening tests many problems that may occur during postoperative period and chemotherapy and/or radiotherapy can be prevented thanks to early intervention (14).

The aim of this study is to determine the preoperative nutritional status of patients with gastrointestinal cancer using different nutritional screening tests and to compare these tests.

2. Materials and Methods

2.1. Study design and sample

A total of 110 patients, including 46 women (42%) and 64 men (58%) aged 19-65 years, who were newly diagnosed with gastrointestinal cancer were included in the study. At the beginning of the study, patients were informed about the research and volunteer patients were included in the study. Written consent was obtained from all participants with the "Informed Consent Form for Research". For the study, approval dated 12.06.2013 and numbered 674 was received from the ethics committee of Hacettepe University.

A questionnaire was applied to the participants by face-to-face interview technique by the researcher. Sociodemographic characteristics of the individuals were asked in the first section of the questionnaire. Anthropometric measurements were taken in the

second section. 24-hour dietary intake record was determined in the third section, and SGA and NRS-2002 nutritional screening tests were applied in the last section of the questionnaire. Body weight, height, upper mid arm circumference (UMAC), and triceps skinfold thickness (TSFT) was measured by the researcher as anthropometric measurements. All anthropometric measurements were held in accordance with the relevant technique (12, 15) Body mass index (BMI) was calculated using body height and body weight data. Body mass divided by the square of the body height (12).

2.2.Dietary intake assessment

In order to get information about nutritional status, 24-hour dietary intake records of the patients were recorded by the researcher (15). Patients were able to eat three meals a day in the hospital. There was also the possibility to provide food and beverage by purchasing from the hospital canteen or from outside or by bringing food and beverages from home. Food consumptions of patients were determined by the researcher through interviewing the patients and their relatives and observing them during the consumption. A computer program that name BEBIS 6.1 was used for the dietary intake levels of the patients, the daily energy and nutrient intakes (energy, protein, fat, carbohydrate, vitamin, mineral) of each patient was determined. Daily energy and nutrient intake levels by gender were compared with the "Daily Required Energy and Nutrient Amounts" in the "Turkey Specific Nutrition Guide" and recommended dietary allowance ratios were calculated (16).

2.3.Nutritional Screening Tools Assessment

Screening tools that name SGA and NRS-2002 were used to evaluate the nutritional status of patients (16). Screening tools were applied face to face to each patient by the researcher and evaluated.

According to SGA, those with SGA A were evaluated as "well nourished", those with SGA B as "moderate malnutrition", and those with SGA C were evaluated as "severe malnutrition".

According to NRS-2002, if the total score was equal to or greater than 3, the patient was considered to be "at nutritional risk".

2.4.Statistical analysis

SPSS 11.5 (SPSS Statistics for Windows, Version 11.5, SPSS Inc., Chicago, USA) package program was used for statistical evaluation of the data. Twenty-four-hour food consumption will be evaluated with the BEBIS (Nutrition Information System) program. Kolmogorov-Smirnov test was used to check whether continuous and discrete numerical variables were normally distributed, and the homogeneity of the variances was investigated by the Levene test. Student's t test, one-way analysis of variance (One Way ANOVA), Mann Whitney U test, Pearson Chi-Square, and Spearman Correlation test were used as statistical analysis methods. Congruence between the two tests was evaluated according to Kappa B. $p < 0.05$ was considered statistically significant.

3.Results

3.1. Patient Characteristics

A total of 110 patients, including 46 women (42%) and 64 men (58%) aged 19-65 years, who were newly diagnosed with gastrointestinal cancer but not operated were included in the study. Mean age was 54.0 ± 8.5 years and participants had stomach (27%), colon (25%), rectum (24%), pancreas (13%) and esophageal (11%) cancers.

According to the NRS-2002 screening test, 54.6% of patients were at high nutritional risk, 33.6% were at moderate nutritional risk, and 11.8% were at low nutritional risk. According to SGA; 9.1% of the participants were well-nourished, 41.8% were evaluated as moderate malnutrition and 49.1% were evaluated as severe malnutrition. These results did not differ according to gender and cancer type ($p>0.05$) (Table 1). Meal skipping was 7.7% in individuals with NRS 2, 45.9% in individuals with NRS 3, and 40% in individuals with NRS 4. There was a statistically significant

difference between groups in terms of meal skipping rates ($p<0.05$), and the rate of those skipping meals in the NRS 3 and NRS 4 groups was significantly higher compared to the NRS 2 group ($p<0.05$).

3.2. Dietary intake

Daily nutritional intake levels of individuals and RDA coverage percentages are shown in Table 2. Energy and nutrient intakes in both genders was lower than the recommended daily amounts. There was no statistically significant difference between men and women in terms of energy and nutritional intake amounts obtained by 24-hour recall dietary assessment forms ($p > 0.05$).

3.3. Anthropometric Measurements

Table 3 shows the change between anthropometric measurements of individuals according to NRS 2002 and SGA scores. Accordingly, there is no significant difference between NRS and SGA scores in terms of continuous body weight, ideal body weight, and height. However, BMI, body weight loss rate, UMAC, and TSFT measurements showed significant differences between the groups according to both NRS 2002 and SGA scores.

3.4. Comparison of Nutritional Screening Tools Assessment

Comparison of nutritional status in men and women according to SGA and NRS 2002 screening tests is given in Table 4. Accordingly, 10.9% of male individuals were in the SGA A group and 12.5% were in the NRS 2002 Score 2 group. 42.2% of male individuals were in the SGA B group and 35.9% were in the NRS 2002 Score 3 group. 46.9% of male individuals were in the SGA C group and 51.6% were in the NRS 2002 Score 4 group. Consequently, the results between SGA and NRS methods were found to be statistically congruent in terms of the distribution of nutritional status of male individuals ($\kappa = 0.631$ and $p <0.001$) (Table 4).

Table 1. Distribution of individuals according to NRS 2002 and SGA scores, demographic and clinical findings

Variables	NRS 2002							SGA						
	Score: 2 (n:13)		Score : 3 (n:37)		Score : 4 (n:60)		p value	Score : A (n:10)		Score : B (n:46)		Score : C (n:54)		p value
	n	%	n	%	n	%		n	%	n	%	n	%	
Total	13	11.8	37	33.6	60	54.6		10	9.1	46	41.8	54	49.1	
Gender							0.759*							0.693**
Male	8	61.5	23	62.2	33	55.0		7	70.0	27	58.7	30	55.6	
Female	5	38.5	14	37.8	27	45.0		3	30.0	19	41.3	24	44.4	
Diagnosis							0.636***							0.150***
Colon	4	30.8	8	21.6	15	25.0		4	40.0	9	19.6	14	25.9	
Stomach	5	38.5	8	21.6	17	28.3		4	40.0	11	23.9	15	27.8	
Esophageal	1	7.7	5	13.5	7	11.7		-	-	7	15.2	6	11.1	
Pancreas	-	-	5	13.5	9	15.0		-	-	4	8.7	10	18.5	
Rectum	3	23.1	11	29.7	12	20.0		2	20.0	15	32.6	9	6.7	
Skipping meals	1	7.7	17	45.9	24	40.0	**0.046*** **	3	30.0	17	37.0	22	40.7	0.793***

** Mann Whitney U test** Pearson's Chi-Square Test *** Likelihood ratio test*

Table 2. Daily energy and nutrient intakes and RDA* coverage percentages of individuals according to gender

Energy and Nutrients	Male (n=64)						Female (n=46)						
	$\bar{X}$	S	Median	Min	Max	RDA (%)	$\bar{X}$	S	Median	Min	Max	RDA (%)	p
Energy (kkal)	1104.9	359.3	1049.3	364.2	2447.9	47.2	1145.9	489.9	1020.5	446.4	2544.8	58.1	0.614
Protein (g)	36.5	17.7	33.5	8.1	115.5	54.1	39.9	24.2	34.7	14.6	128.9	69.2	0.396
Protein (E%)	13.1	4	12.7	7.8	25.3	-	13.2	3.35	13.3	6.9	21.9	-	0.731
Carbohydrate (g)	125.8	49.7	127.2	18.1	268.2	-	129.6	64.2	125.0	37.3	295.8	-	0.503
Carbohydrate (E%)	45.3	11.3	45.8	8.4	74.1	-	45.1	9.8	46.3	19.8	65.7	-	0.095
Fat (g)	46.7	18.9	42.0	18.9	105.8	-	49.4	22.1	42.9	18.4	105.8	-	0.764
Fat (E%)	37.8	7.1	37.6	19.4	52.9	-	38.4	7.0	38.9	24.7	55.6	-	0.603
Cholesterol (mg)	132.5	91.9	110.5	8.4	362.2	-	164.2	104.8	151	30.5	426.1	-	0.831
Fiber (g)	10.8	5	9.6	2.8	29.6	37.4	11.2	5.8	9.8	3.8	26.5	49.7	0.832
Vitamin A (mcg)	592.1	508.5	430.3	71.8	2344.4	65.8	542.5	468.9	410.3	50.6	2344.4	77.5	0.772
Vitamin E (mg)	12.1	7.1	10.6	2.7	32.7	80.6	11.8	6.9	10.3	2.6	32.7	78.6	0.232
Vitamin C (mg)	50.3	35.2	39.3	5.9	142.8	55.9	48.9	33.9	39.9	5.3	142.8	54.3	0.938
Vitamin B1 (mg)	0.4	0.2	0.4	0.1	1.2	35.2	0.4	0.2	0.4	0.2	0.9	39.3	0.36
Vitamin B2 (mg)	0.7	0.3	0.7	0.2	1.6	53.2	0.7	0.3	0.8	0.3	1.5	68.8	0.786
Iron (mg)	5.7	2.7	4.9	1.2	14.4	57.4	5.8	3.1	5.1	1.9	16.4	47.9	0.346
Phosphorus (mg)	556.2	222.2	501.5	152	1371.9	79.4	599.8	275.1	552.7	218.2	1304.4	85.7	0.777
Potassium (mg)	1182.8	501.4	1054.7	262.5	2607.6	-	1209.9	532.4	1041.8	367.6	2462.2	-	0.772
Calcium (mg)	367.9	140.1	339.0	127	733.9	32.3	396.1	171.5	356.1	144.7	919.7	35.4	0.138
Magnesium (mg)	129.5	55.9	114.5	33.7	291.9	30.9	126.3	59.6	105.8	12.4	255.9	39.5	0.614
Zinc (mg)	5.2	2.5	4.6	1.3	12.3	47.4	5.4	2.8	4.5	2	15.2	53.6	0.396
Sodium (mg)	2362.2	1132.6	2094.8	638.7	8503.1	-	2758	1645.4	2603.3	639.3	8809.9	-	0.731

** RDA-Recommended Dietary Allowance*

In this study 6.5% of female individuals were in the SGA A group and 10.9% were in the NRS 2002 Score 2 group (Table 5), 41.3% of female individuals were in the SGA B group and 30.4% were in the NRS 2002 Score 3 group, 52.2% of female individuals were in the SGA C group and 58.7% were in the NRS 2002 Score 4 group. Accordingly, the results between SGA and NRS methods were found to be statistically congruent in terms of the distribution of nutritional status of female individuals ($\kappa = 0.729$ and $p < 0.001$).

When the nutritional status of all individuals was examined according to the results of the screening tests used in the study, it was found that 9.1% of all participants were in the SGA A group and 11.8% were in the NRS 2002 Score 2 group. 41.8% of all individuals were in the SGA B group and 33.6% were in the NRS 2002 Score 3 group. 41.9% of all individuals were in the SGA C group and 54.6% were in the NRS 2002 Score 4 group. Accordingly, the results between SGA and NRS methods were found to be statistically congruent in terms of the distribution of nutritional status of all individuals ($\kappa = 0.671$ and $p < 0.001$).

In addition, a significant positive correlation was found between SGA scores and NRS scores ($r = 0.786$ and $p < 0.001$).

Table 3. Mean ($\bar{x}$) and standard deviation (S) values of anthropometric measurements of individuals according to NRS 2002 and SGA score groups

Anthropometric measurements	NRS 2002						p value*	SGA						p value*
	Score:2		Score :3		Score :4			Score : A		Score : B		Score :C		
	$\bar{x}$	S	$\bar{x}$	S	$\bar{x}$	S		$\bar{x}$	S	$\bar{x}$	S	$\bar{x}$	S	
Continuous body weight (kg)	72.5	12.49	75.2	12.3	72.3	13.30	0.554	70.9	13.68	74.6	12.18	72.6	13.34	0.621
Last body weight (kg)	70.3	12.64	66.6	9.59	58.5	11.37	**<0.001**	70.3	13.69	66.2	11.29	58.1	10.23	**<0.001**
Ideal body weight (kg)	64.4	8.08	68.5	7.61	66.5	6.94	0.178	65.7	6.04	67.1	8.25	67.1	6.85	0.848
Ideal body weight ratio (%)	109.2	13.44	97.5	11.3	88.6	19.80	**<0.001**	106.5	14.40	99.6	19.49	86.9	14.03	**<0.001**
Continuous body weight ratio (%)	97.0	4.69	89.2	7.54	81.2	8.59	**<0.001**	99.1	3.05	89.0	7.03	80.6	8.67	**<0.001**
Body weight loss rate (%)	3.0	4.69	10.8	7.54	18.8	8.59	**<0.001**	0.9	3.05	11.0	7.03	19.4	8.67	**<0.001**
Height (cm)	162.5	9.25	167.7	9.32	164.9	8.42	0.131	165.0	7.48	165.6	9.72	165.6	8.57	0.980
BMI (kg/m^2)	26.5	3.18	23.6	2.41	21.6	4.66	**<0.001**	25.6	3.44	24.2	4.33	21.2	3.49	**<0.001**
Upper mid arm circumference (cm)	29.1	3.40	27.5	3.24	25.7	3.19	**<0.001**	29.0	4.14	27.4	3.03	25.6	3.29	**0.002**
Triceps SFT (mm)	17.6	5.84	15.0	4.58	11.5	5.43	**<0.001**	18.0	5.09	14.9	5.57	11.3	4.88	**<0.001**
Upper mid arm muscle area (cm^2)	23.4	7.78	20.0	7.01	16.6	6.40	**0.002**	23.1	9.43	19.9	6.32	16.6	6.75	**0.006**
Upper mid arm muscle circumference (cm)	19.9	2.33	18.9	2.22	17.6	2.19	**<0.001**	19.9	2.84	18.8	2.08	17.6	2.25	**0.002**
Upper mid arm fat area (cm^2)	36.1	9.26	32.3	7.49	28.2	6.93	<0.001	36.1	11.0	32.0	6.99	28.2	7.15	**0.002**

**One-Way ANOVA.*

Table 4. Comparison of nutritional status in men and women according to SGA and NRS 2002 screening tests

	NRS: 2		NRS: 3		NRS: 4		Total		p value*
	Number	%	Number	%	Number	%	Number	%	
Male									
SGAA	5	7.8	2	3.1	-	-	7	10.9	<0.001
SGAB	3	4.7	18	28.1	6	9.4	27	42.2	
SGAC	-	-	3	4.7	27	42.2	30	46.9	
Total	8	12.5	23	35.9	33	51.6	64	100.0	
Female									
SGAA	3	6.5	-	-	-	-	3	6.5	<0.001
SGAB	2	4.4	13	28.2	4	8.7	19	41.3	
SGAC	-	-	1	2.2	23	50	24	52.2	
Total	5	10.9	14	30.4	27	58.7	46	100.0	
All participants									
SGAA	8	7.3	2	1.8	-	-	10	9.1	<0.001
SGAB	5	4.5	31	28.2	10	9.1	46	41.8	
SGAC	-	-	4	3.6	50	45.5	54	49.1	
Total	13	11.8	37	33.6	60	54.6	110	100.0	

** Pearson's Chi-Square test. Kappa test*

4. Discussion

Cancer is a serious health problem leading to high morbidity and mortality rates. In the last two decades, life expectancy of cancer patients has increased significantly with effective multi-faceted treatment approaches, and nutritional problems associated with cancer and cancer treatment have become important causes of morbidity and mortality (17). Early detection of nutritional disorders and starting the necessary nutritional support is important in terms of increased the response to chemotherapy, decreased infection rates, and increased clinical response and life expectancy. In this respect, nutritional screening tests should be used effectively at admission to the hospital and repeated during hospitalization in order to reduce and prevent mortality and morbidity and reduce the length of hospital stay (17).

Numerous studies have investigated the nutritional status of cancer patients (18-20). The prevalence of malnutrition has been reported as in pancreas (66.7%), esophagus/stomach (60.2%), head and neck (48.9%), lung (45.3%), ovary/uterine (44.8%), colon/rectal (39.3%), leukemia/lymphoma (34.0%), breast (20.5%) and prostate (13.9%) cancers (14). The incidence of malnutrition in these patients varies depending on the type of cancer. In the present study, malnutrition levels of GIS cancer types were evaluated and generally found to be high growth rate. Borges et al. (21) suggested that GIS cancer patients are at 23 times more risk of malnutrition than patients without GIS cancer. However, no significant difference was found in the present study when the malnutrition levels of patients with GIS cancer were evaluated according to gender. The reason behind this may be that in cases with GIS cancer, gender is not a variable that affects disease prevalence.

Gastrointestinal cancers can significantly affect nutritional status. Host response to tumor and tumor-induced factors can have a profound effect on fat metabolism and protein synthesis and worsen the risk of malnutrition (9). The recommended daily energy

intake of a cancer patient who is not bed-dependent is 30-35 kcal/kg (22). When calculating protein requirements, 1.0-1.2 g/kg/day for stress-free cancer patients, 1.2-1.6 g/kg/day for hypercatabolism, and taking stress levels into account is recommended (23). While there is no definitive recommendation available, the World Cancer Research Fund (WCRF) recommends cancer patients to avoid carbohydrate and fat intake, sugary drinks, refined grains, and processed meat products, while consuming vegetables and fruits without whole grains, legumes and starch, and restricting weekly red meat consumption (24). According to Turkey Specific Nutrition Guide 2015 (TUBER), in a healthy diet, 50-60% of daily energy intake is recommended to be obtained from carbohydrates, 10-20% from proteins, and 20-35% from fats (25). In the present study, the contribution of energy from carbohydrates consumed was below 50% in both genders, whereas the percentage of energy from fats was above 35%. It has been reported that excessive fat intake may cause relapses in breast, colon and prostate cancer cases and increase the risk of mortality (26). In the present study, daily energy and nutrient intakes of individuals with GIS cancer were also evaluated according to different malnutrition screening tests. Accordingly, as the degree of malnutrition increases in both screening tests, the intake of energy and nutrients tends to decrease. In a study conducted in cancer patients over 60 years of age, statistically significant differences were found in daily energy, carbohydrates, protein and fats consumption between the PG-SGA groups (A, B and C) of. Energy and protein amount per kilogram and the percentage of total energy coming from fat decreased from PG-SGA group A to C, but the results were not statistically significant (27). Many factors such as the severity of the disease, possible negative psychological status that may be experienced in the preoperative period, and stopping food intake of due to tests and examinations may explain this decrease in nutrition. There are many studies showing that preoperative malnutrition causes delay in postoperative recovery, increases risk of complications, and prolongs hospital stay (28).

There are many studies in the literature showing that vitamins and minerals play an important role in protection against cancer (29-31). They are involved in cell proliferation and development, the formation and maintenance of cell membrane structure, the formation of immune substances and gene transcripts (32). In addition, their general protective effect in cancer is to prevent the formation of carcinogens, increase detoxification, control cell replication, malignancy and transformation, and ensure intracellular communication (32). Epidemiological studies show an inverse relationship between vitamin D and colon and rectum cancers (33). In addition, the administration of vitamin C and its precursor B-carotene in stomach cancers related to Helicobacter pylori reduces this risk(34). Moreover, there are studies showing that high vitamin E reduces the risk of gastrointestinal cancer in patients with high selenium levels, while calcium reduces the risk of colorectal adenoma(35, 36). In the present study, it was found that vitamins and minerals were consumed at different levels according to gender, but the RDA requirements were not met. There is no specific nutritional guide for the intake of micronutrients in cancer patients (37).

The physiological effects that develop with cancer and the simultaneous change in nutritional status may cause serious changes in body weight loss and protein and fat ratios (15). Nutritional deficiency is a common problem in critical cancer patients and is associated with poor clinical outcome. It is reversible especially with nutritional support. Some studies have shown that patients with malignant gastrointestinal disease have a higher prevalence of about 10% additional weight loss during the first preoperative and postoperative months(38). In the present study, as the degree of malnutrition increased according to both screening tests, body weight loss rate increased significantly. There was a statistically significant difference between the NRS groups in terms of average weight loss rates, and as we moved from NRS 2 to NRS 4, there was a statistically significant increase in the average weight loss rate. Ryu et al (17) found that the weight loss rate of individuals with NRS <3 was 0.89 ± 1.4%, while the weight loss rate of individuals with NRS ≥3 was 6.42 ± 4.6%. Also Gavezzi et al (39) determined that body weight loss rate was 1.4 ± 2.7% in patients with NRS <3, and 10.4 ± 5% with patients with NRS ≥3 in patients with gastric cancer,. In the present study, similar body weight loss was also observed in the SGA screening test. As we go from SGA A to SGA C, there is a statistically

significant increase in the average weight loss rate. Ryu et al. (17) indicated that the weight loss rate of individuals with SGA A was 1.03 ± 1.5%, while the weight loss rate of individuals with SGA B or C was 7.31 ± 4.5%. The weight loss rate of those with SGA B or C was statistically higher than individuals with SGA A. In the same study, weight loss rate showed a positive correlation with SGA and NRS scores. However, BMI and other anthropometric measurements showed an inverse relationship (17). In the present study, there was a statistically significant difference between the groups in terms of mean BMI, and it was found that the BMI value of the NRS 4 group was significantly lower compared to the NRS 2 and NRS 3 groups. BMI having a decreasing trend from NRS 2 to NRS 4 is expected. In the study conducted by Gavezzi et al (39) on patients with gastric cancer, BMI values of patients with NRS <3 were 26.1 ± 3.2 kg/m², and BMI values of patients with NRS ≥3 were 22.6 ± 3.9 kg/m². Similarly, a significant decrease was also seen in SGA. Bauer et al (40) obtained consistent results; individuals with SGA A had a BMI of 26.2 ± 4 kg/m², individuals with SGA B had a BMI of 24.5 ± 4.9 kg/m², individuals with SGA C had a BMI of 19.4 ± 2.2 kg/m² and the decrease in BMI according to SGA scores was statistically significant. In some cases, although BMI values were normal, patients were in malnutrition according to SGA and NRS-2002. Therefore, it can be said that using only BMI values alone is not sufficient to evaluate the nutritional status of the patient. Aydın et al. (41) reported in their study that SGA results can detect malnutrition, even if patient's BMI is normal. Wakahara et al (42) found that there was a negative correlation between BMI, upper mid-arm muscle circumference, TSFT, albumin values and SGA scores, and this relationship was statistically significant. Ryu et al (17) the individuals with upper mid arm circumference measurements were found to be significantly lower in individuals with NRS ≥3 compared to those with NRS <3. In the same study, TSFT was 18.25 ± 7.8 mm in individuals with NRS <3 and 14.44 ± 6.4 mm in individuals with NRS ≥ 3, and this difference was statistically significant (17). Wu et al (43) TSFT was 10.17 mm and above in patients with normal nutritional status, 9.04-10.17 mm in those with mild malnutrition, 6.78-9.03 mm in those with moderate malnutrition, and 6.78 mm and below in those with severe malnutrition. In the study conducted by Filipovic et al. (44), mean TSFT was 9.92 ± 2.47 mm, mean UMAC was 28.28 ± 2.7 cm, and UMAMC was 11.56 ± 2.62 cm in patients with good nutritional status. Mean measurements of patients in malnutrition were 5.25 ± 1.77 mm, 23.21 ± 2.06 cm, and 8.23 ± 10.47 cm, respectively. Similarly, in the present study, there was a statistically significant difference between both NRS groups and SGA scores in terms of mean UMAC, TSFT, upper mid-arm muscle area and circumference, and these measurements decreased as the severity of malnutrition increased. Anthropometric measurements of patients with cancer are expected to be below the reference values. It is possible to explain this situation with the changing physiological condition and decreased food intake(45, 46).

Although there are various nutritional assessment tools to evaluate hospitalized patients in terms of nutritional risk, there is still no consensus on which tools to recommend (47). The lack of a standard test can also be attributed to the lack of a well-defined understanding of "nutritional risk". Improper risk grouping of patients with improper tests causes wrong intervention to the patient, delay in intervention, and wasted resources. An ideal nutritional risk assessment test should have high sensitivity and specificity, be applied easily and quickly, and be able to detect patients with moderate and severe malnutrition for early intervention (47). In the present study, NRS-2002 and SGA screening tests were applied and their results were compared. It was therefore evaluated whether the proportion of patients identified as at risk of malnutrition or having malnutrition varied with different screening tools. Accordingly, the results were found to be significantly congruent in terms of the distribution of nutritional status between SGA and NRS-2002 screening tests. In addition, a significant positive correlation was found between SGA and NRS scores. Ryu et al (17) the results were significantly congruent between SGA and NRS-2002 tests in terms of the distribution of nutritional status. In the study performed by Kyle et al. (48), 28% of patients had moderate or high nutritional risk according to NRS-2002, while 39% had moderate or severe malnutrition according to SGA. These studies reported that the results of screening

tests were compatible. Therefore, at least one screening test should be used in the establishment of hospital protocols. In this way, it will be possible to detect the patient before having malnutrition and, accordingly, to provide early nutritional support to the patient.

In conclusion, malnutrition screening tests may not be very effective in detecting potential malnutrition problems if they are not repeated at regular intervals. Especially in patients with gastrointestinal system cancer, tests should be performed at hospitalization and patients should be followed up for malnutrition and necessary interventions should be performed early. Screening tests should be repeated at least once a week during hospital stay. By doing so, many postoperative complications can be prevented, hospital stay can be shortened and thus, contribution can be made to decrease healthcare expenses. All health personnel who are in contact with the patient have important duties in determining such conditions, whereas the dietitian and the doctor in particular have significant duties during treatment. In addition, protocols for routine use of screening tests should be established in hospitals and all healthcare facilities.

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