Identifying Malnutrition in Oncology Outpatients Using Different Screening Tools

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ABSTRACT

Objective: To compare the results of different nutritional screening tools, including NRS-2002, PG-SGA, and NUTRISCORE for the detection of malnutrition in oncology outpatients.

Study Design: A descriptive study.

Place and Duration of the Study: Daily Chemotherapy Unit, Umraniye Training and Research Hospital, Istanbul, Turkiye, between June and July 2021.

Methodology: A total of 69 patients were included in the study, receiving cancer therapy in an outpatient setting. The NRS-2002, PG-SGA, and NUTRISCORE scores were calculated to determine the nutritional status.

Results: The mean age of the patients was 56.74 ± 13.48 years, and 59.4% were females. The mean BMI was 27.29 ± 5.27 kg/m^2. Among the patients, 55.1% had insufficient nutritional intake or were at risk of malnutrition according to the NRS-2002, 40.6% according to NUTRISCORE, and 59.4% according to the PG-SGA. There was a significant agreement between the results of the NRS-2002 and PG-SGA in a McNemar test (Kappa: 0.320, p = 0.008).

Conclusion: NRS-2002 and PG-SGA tools offered greater sensitivity in terms of capturing more patients in the precachectic state than NUTRISCORE. Among these, the NRS-2002 is a shorter test, and thus, would seem to be more practical than the PG-SGA.

Key Words: *Oncology, Malnutrition, Screening tools, NRS-2002, PG-SGA, NUTRISCORE.*

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INTRODUCTION

Malnutrition is a common condition, especially among older individuals and those with chronic conditions receiving medical care in the hospitals. It can lead to a decrease in quality of life, an increased risk of morbidity and infection, impaired immune defense mechanisms, prolonged wound healing, decreased muscle strength, and increased mortality.[1]

Malnutrition is frequently observed in cancer patients due to gastrointestinal dysfunction caused by either the malignancy or the therapies used in treatment.[2] This can occur at any point during the patient's hospitalisation, from initial admission to treatment. Detecting malnutrition upon a patient's initial admission enables early implementation of preventive measures. Such interventions can positively impact the entire treatment course, as well as mortality and morbidity.[3]

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Weight loss and malnutrition are common in cancer patients due to decreased dietary intake caused by treatment-related side effects such as nausea, vomiting, lack of appetite, mouth sores, and constipation, as well as metabolic changes resulting from the disease itself.[4] Malnutrition can have severe clinical consequences, including prolonged hospitalisation, increased risk of infections, and decreased survival. To minimise these effects, it is recommended that all patients undergo nutritional risk-screening upon admission to the hospital to determine appropriate nutritional interventions for those at risk of malnutrition.[1] The assessment of nutritional status should include both subjective and objective parameters.[5] The nutritional risk-screening tools used to assess nutritional status should be fast, practical, economical, sensitive, reproducible, and validated.

The initial stage in identifying inadequate nutritional status is to identify individuals at risk of malnutrition and evaluate them using screening tools.[6] Screening tools for malnutrition aim to minimise the complications of malnutrition by identifying those at risk of malnutrition. These tools should be fast, accurate, and should not increase the workload.

Malnutrition can manifest at varying degrees of severity across different types of cancer. Currently, there are studies indicating that different screening tools may be appropriate for different types of cancers, in addition to identifying malnutrition.[7]

Although NRS-2002 is primarily recommended for inpatients and PG-SGA for adult patients, their superiority over each other varies, particularly in special groups such as cancer patients.[8]

There is no universal screening tool that can be used for all patient groups. While some tests provide screening, others provide assessment. However, in the case of cancer patients, the primary objective is to identify malnutrition through early-stage screening.[9]

The objective of this study was to compare the results of three screening tools: NRS-2002, PG-SGA, and NUTRISCORE. These tools were administered to oncology outpatients undergoing cancer therapy. The study also aimed to demonstrate the sensitivity of these tests in identifying malnutrition in oncology outpatients.

METHODOLOGY

This study was conducted at the Umraniye Training and Research Hospital (Istanbul / Turkiye) between June and July 2021. During the two months of the study (between June 1 and August 1), a total of 69 patients receiving chemotherapy as outpatients in the oncology outpatient unit of the hospital were included in the study. The inclusion criteria were being between 18-85 years of age, receiving outpatient chemotherapy treatment for a malignancy, not having a neurological disease that may cause muscle loss, and agreeing to take part in the study. In the power analysis performed for the study, the minimum number of patients to be included in the study was calculated as 59, based on an effect size of 0.4 in the t-test, One-Way, Type-1 error at the 0.05 level, and Type-2 error at the 0.95 level.

The sociodemographic characteristics of the patients were recorded, and body weight and height were measured for the calculation of body mass index (BMI) by a dietitian with a Desis B5 height weight meter. The NRS-2002, PG-SGA (not short form) and NUTRISCORE scores were calculated for the determination of nutritional status. The data were collected using a face-to-face interview by a nutrition nurse. The participants were informed that participation in the study was entirely voluntary and their consent for inclusion and the approval of the relevant institution were obtained.

Among the scoring systems used in the present study, the assessment of patients using the NRS-2002 begun with a pre-screening test, including four questions about the body mass index (BMI) of the patient having less than 20.5 kg/m^2, any weight loss experienced in the last three months, a decrease in nutritional intake in the last one week; and any impairment in overall health status. The test continued with further assessments when a positive response was given to at least one of these four questions, including scoring of the decrease in dietary intake and the magnitude of weight loss in the final assessment section. Accompanying chronic diseases and acute conditions were also scored, and an additional point was added if the patient was 70 years old or above. PG-SGA evaluates the patients' anthropometric measurements (such as muscle strength and subcutaneous fat-thickness) and independence in daily activities, in addition to diseases, appetite status, and weight loss. It differs from the classical SGA test as it assesses malnutrition by providing an objective scoring, and differs from the NRS-2002 in that it includes anthropometric measurements. NUTRISCORE is similar to PG-SGA as it also scores the patient according to the degree of weight loss. However, it scores the patient's current diseases and treatments according to how much malnutrition they may cause. In this respect, it differs from both PG-SGA and NRS-2002.

The study data were analysed using the IBM SPSS Statistics (Version 22.0. Armonk, NY: IBM Corp.) Software Package. A Shapiro-Wilk test was used to test the normality of the distribution of the study parameters. In addition to descriptive statistics (mean, standard deviation, frequency), a Student's t-test was used to compare the parameters with normal distribution between the groups. Yates' correction for continuity was used to compare qualitative data, and the Kappa agreement coefficient was calculated. McNemar's test was used on paired nominal data. A p-value less than 0.05 was considered statistically significant.

RESULTS

The mean age of the subjects was 56.74 ± 13.49 (26-84) years, and 59.4% (n = 41) were females. BMI levels of the patients were 27.29 ± 5.27 (17.7-43.5), and 40.6% were overweight. The three most common malignancies in the patients included in the study were breast cancer 26.1% (18), lung cancer 18.9% (13), and gastrointestinal tractus cancers 18.9% (13). The rest of the list can be seen in Table I.

The mean NRS-2002, NUTRISCORE, and PG-SGA scores were 2.87 ± 1.47 (1-6), 4.45 ± 3.41 (1-19), and 5.71 ± 4.46 (1-36), respectively. It was determined that 55.1% of the patients had a diagnosis of malnutrition risk according to NRS-2002, 40.6% according to NUTRISCORE, and 59.4% according to PG-SGA.

When the relationship between the screening tools and demographic data was analysed, it was found that the age of the subjects who were at risk of malnutrition according to NRS-2002 was significantly higher than those who were not ($p = 0.001$; $p < 0.01$), whereas no relationship was found between gender and BMI. According to NUTRISCORE and PG-SGA, no correlation was found between age, gender, and BMI in subjects with and without malnutrition ($p > 0.05$, Table I).

The level of agreement between NUTRISCORE and NRS-2002 results was 54.5% and was found to be statistically significant (Kappa coefficient of agreement: 0.545; $p < 0.01$). According to the NUTRISCORE result, malnutrition was detected in 40.6% (n = 28) of the patients, whereas according to the NRS-2002 result, malnutrition was detected in 55.1% (n = 38) of the patients. While 28 cases with positive NUTRISCORE results were detected, 89.3% (n = 25) of these cases were found to be positive and 10.7% (n = 3) were found to be negative by NRS-2002. Accordingly, the sensitivity of the test was 89.3%, specificity was 68.3%, positive predictive value was 65.8%, negative predictive value was 90.3%, and accuracy was 76.8% (Table II).

Table I: Evaluation of general patient characteristics by three screening tests.

		NRS-2002-Group			NUTRISCORE-Group			PG-SGA-Group		
		No. mln. risk	Risk of mln.		No. mln. risk	risk of mln.		No. mln. risk	Risk of mln.	
		Mean ± SD	Mean ± SD	p-value	Mean ± SD	Mean ± SD	p-value	Mean ± SD	Mean ± SD	p-value
Age		49.68 ± 12.11	62.5 ± 11.81	[1]0.001*	54.37 ± 14.15	60.21 ±11.85	[1]0.077	55.61 ± 13,67	57.51 ± 13.47	[1]0.568
BMI		28.05 ± 4.38	26.68 ± 5.89	[1]0.287	28.03 ± 5.07	26.21 ± 5.47	[1]0.162	27.4 ± 3.25	27.21 ± 6.33	[1]0.872
		n (%)	n (%)		n (%)	n (%)		n (%)	n (%)	
Gender	Male	10 (32.3%)	18 (47.4%)	[2]0.204	16 (39%)	12 (42.9%)	[2]0.750	13 (46.4%)	15 (36.6%)	[2]0.414
	Female	21 (67.7%)	20 (52.6%)		25 (61%)	16 (57.1%)		15 (53.6%)	26 (63.4%)	
		No. mln. risk (%)	Risk of mln. (%)		No. mln. risk (%)	Risk of mln. (%)		No. mln. risk (%)	Risk of mln. (%)	
Diagnoses	Breast cancers	15 (83)	3 (17)		13 (72)	5 (28)		10 (55)	8 (45)	
	Lung cancers	3 (23)	10 (77)		7 (54)	6 (46)		5 (38)	8 (62)	
	GIT cancers	2 (15)	11 (85)		5 (38)	8 (62)		4 (30)	9 (70)	
	Haematological cancers	3 (30)	7 (70)		5 (50)	5 (50)		5 (50)	5 (50)	
	Gynaecological cancers	1 (20)	4 (80)		2 (40)	3 (60)		1 (20)	4 (80)	
	Urologic cancers	4 (80)	1 (20)		5 (100)	0 (0)		2 (40)	3 (60)	
	Brain cancers	2 (100)	0 (0)		2 (100)	0 (0)		1 (50)	1 (50)	
	Other cancers	1 (33)	2 (67)		2 (67)	1 (33)		0 (0)	3 (100)	

*[1]Student's t-test, [2]Pearson's Chi-square test, *<0,05, Mln: Malnutrition, GIT: Gastrointestinal tract, BMI: Body mass index.*

Table II: Evaluation of NRS-2002 compliance with NUTRISCORE.

		NUTRISCORE			p-value
		Negative n (%)	Positive n (%)	Total n (%)	
NRS-2002	Negative	28 (68.3)	3 (10.7)	31 (44.9)	0.545
	Positive	13 (31.7)	25 (89.3)	38 (55.1)	
	Total	41 (59.4)	28 (40.6)	69 (100)	
Sensitivity		89.3			
Specificity		68.3			
Positive predictive value		65.8			
Negative predictive value		90.3			
Accuracy		76.8			
AUC		0.788			

*McNemar test *p <0.05.*

Table III: Evaluation of PG-SGA compliance with NUTRISCORE.

		NUTRISCORE			p-value
		Negative n (%)	Positive n (%)	Total n (%)	
PG-SGA	Negative	20 (48.8)	8 (28.6)	28 (40.6)	0.188
	Positive	21 (51.2)	20 (71.4)	41 (59.4)	
	Total	41 (59.4)	28 (40.6)	69 (100)	
Sensitivity		71.4			
Specificity		48.8			
Positive predictive value		48.8			
Negative predictive value		71.4			
Accuracy		57.9			
AUC		0.601			

*McNemar test *p <0.05.*

The level of agreement between NUTRISCORE and PG-SGA results was 18.8% and was not statistically significant (Kappa coefficient of agreement: 0.188; p >0.05). According to the NUTRISCORE result, malnutrition was detected in 40.6% (n = 28) of the patients, whereas according to the PG-SGA result, malnutrition was detected in 59.4% (n = 41) of the patients. While 28 cases with positive NUTRISCORE results were detected, 71.4% (n = 20) of these cases were found to be positive and 28.6% (n = 8) were found to be negative by PG-SGA. Accordingly, the sensitivity of the test was 71.4%, specificity was 48.8%, positive predictive value was 48.8%, negative predictive value was 71.4%, and accuracy was 57.9% (Table III).

DISCUSSION

This study aimed to determine which test would detect a higher risk of malnutrition and whether there is a superiority between the tests in this respect.

Malnutrition is commonly encountered in patients diagnosed with cancer, and negatively affects prognosis. Nutrition is considered an important part of the cancer therapy as changes in nutritional status can occur at any point, from the time of diagnosis to the start and continuation of therapy. In 10-20% of the cancer patients, malnutrition may be the cause of death rather than the malignancy itself. Therefore, it is important to monitor and address nutritional needs

throughout the course of the treatment. In a multicentre Chinese study involving 1,482 patients with oesophageal cancer, 745 patients had an NRS-2002 score of ≥3 indicating a malnutrition risk in 50% of the patients, and 1,130 patients had a PG-SGA score of ≥4 indicating a malnutrition risk in 76% of the patients.[10] In the present study, malnutrition risk was detected in 55.1% of the patients using the NRS-2002, in 40.6% of the patients using the NUTRISCORE, and in 59.4% of the patients using the PG-SGA.

The same Chinese study found a higher risk of malnutrition in females than in males.[10] In the present study, there was no difference in terms of the detection of malnutrition between genders in the three screening tests.

Literature reports that the prevalence of malnutrition increases in older people.[11] In a study evaluating nutritional status in cancer patients, Viana *et al.* reported a median age of 62 years, while the mean age in the present study was 56.74 ± 13.48 years.[12] In this study, it was found that patients identified as at risk of malnutrition according to the NRS-2002 were significantly older. The risk of malnutrition identified using other screening tests also increased with age, although this difference was not statistically significant. The NRS-2002 takes into account the patients' age when calculating the final score, which may explain this difference.

Obesity is a significant risk factor for cancer development. Previous studies have reported that BMI is lower in patients with malnutrition than in those who are not at risk the of malnutrition.[13] In a Pakistani study, Malik *et al*. showed that obese inpatients were more at risk of malnutrition.[14] In a study conducted with 1,913 cancer patients over the age of 18 years, the BMI classification of patients aged 65 and over was similar to this study. Specifically, 37.7% of the individuals participating in the study were normal, 26.4% were overweight, and 25.5% were found to be obese.[15] Kubrak *et al.* conducted a study on hospitalised adult cancer patients and found that the mean BMI was 23.3 ± 5.3 kg/m^2. According to the BMI classification, 18.9% of the patients were underweight, 46.3% were normal, 23.2% were mildly obese, and 11.6% were obese.[16] The present study results showed that the patients had a mean BMI of 27.29 ± 5.27, with 40.6% falling into the pre-obese category. It was found that the patients had a higher BMI than what is reported in the literature.

In a prospective study conducted in Brazil evaluating the nutritional status of 78 women with breast cancer using the PG-SGA, an extremely low rate of inadequate nutrition was reported.[17] The analysis of three screening tests used in the present study revealed the number of patients at risk of malnutrition to be lower in those with breast malignancies than in those with gastrointestinal tract and lung malignancies. The incidence of malnutrition according to tumour location is reported to be higher in the patients with upper gastrointestinal system, head and neck cancers, and lung cancer.[15] Planas *et al.* reported the prevalence of malnutrition risk according to the location of the tumour at the time of hospital admission; 47.4% in patients with cancers of the upper gastrointestinal tract; 45.0% in patients with tumours of the pancreas, liver or biliary tract; 42.9% in patients with cancers of the respiratory system; it was found in 39.1% of patients with tumours of the lower gastrointestinal tract and 36.8% in patients with haematological neoplasms.[18] The NUTRISCORE screening test, which was developed by Arribas *et al*. in 2017 to define the nutritional status of outpatient oncology patients, was found to have a sensitivity of 97.3% and a specificity of 95.9% when PG-SGA is taken as a reference.[19] In the present study, the sensitivity of the NRS-2002 test was 89.3%, the specificity was 68.3%, the sensitivity of the PG-SGA test was 71.4%, and the specificity was 48.8%. In another remarkable study, Pan *et al.* compared PG-SGA and NRS-2002 in nasopharyngeal cancer patients and concluded that NRS-2002 score ≥2 can be considered as a new cut-off point for nutritional assessment.[20]

The degree of agreement (Kappa coefficient) between the NRS-2002 and PG-SGA was 32%, which was statistically significant. The authors recommend the use of NRS-2002 in this patient group due to its ease and practicality of clinical application.

Cancer patients experience weight loss due to multiple reasons. Cancer cachexia is a syndrome characterised by weight loss, decreased calorie intake, and metabolic alterations. Early recognition of malnutrition in the precachectic state is crucial in preventing further progression of this syndrome. The present study found that the NRS-2002 and PG-SGA tools were more sensitive in detecting malnutrition.

The NRS-2002 test appears to be more practical than the PG-SGA in capturing more patients in the precachectic state than NUTRISCORE, as it is a shorter test.

This study used a cross-sectional research design. It is important to note that the findings of this study cannot be generalised due to the limited number of the cases and the fact that it was conducted in only one health institution. However, the study provides valuable insights for future research on the evaluation of nutritional needs of outpatient oncology patients. It is recommended that future studies include prospective and interventional designs, as well as 3-day food consumption lists in the analysis.

CONCLUSION

Detecting malnutrition in cancer patients is crucial for enhancing their quality of life, increasing survival rates, and reducing the risk of complications. Although there is no single standardised screening test recommended for cancer patients, both NRS-2002 and PG-SGA tests applied in this study

detected a similar proportion of patients at the risk of malnutrition. However, the authors recommend using NRS-2002 due to its ease of application.

ETHICAL APPROVAL:
An approval was obtained from the Umraniye Training and Research Hospital, Istanbul, Turkiye's Clinical Research Ethics Committee on 27-05-2021 with registration no. 2021/170.

PATIENTS' CONSENT:
All participants provided written informed consent prior to the participation.

COMPETING INTEREST:
The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:
EBO, GK: Concept, manuscript writing, and critical review.
SD: Data collection, manuscript writing, and critical review.
EY: Design of the manuscript.
FA: Data collection, analysis, and interpretation.
SB: Concept and critical review.
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