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**ARAŞTIRMA YAZISI** / ORIGINAL ARTICLE

# Malnutrition Prevalence and Consistency of Malnutrition Screening Tools and Anthropometric Measures Among Adult Cancer Patients in a Private Hospital: A Cross-Sectional Study

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**ABSTRACT**

**Objectives:** Malnutrition is a common complication seen among cancer patients and may affect morbidity and mortality. Thus, evaluation of nutritional status and screening for malnutrition is crucial both for prevention and intervention. In this cross-sectional study, we aimed to evaluate malnutrition prevalence and compare two malnutrition screening tools and anthropometric measures among adult cancer patients.

**Material and Method:** The study was conducted in a private hospital with 59 patients between 7th of January and 7th of April in 2016. Nutritional screening and assessment tools and measurements were applied 48 hours after the patient was admitted to the hospital. We used two tools for detecting malnutrition which are Nutritional Risk Screening-2002 (NRS-2002) and Subjective Global Assessment (SGA). Anthropometric measurements were body mass index (BMI), triceps skinfold thickness (TST), and mid-upper arm circumference (MUAC).

**Results:** According to NRS-2002 results, 41% of the patients were under nutritional risk and SGA results were consistent regarding malnutrition screening ($p<0.05$). SGA results showed that 15% of the patients were moderately malnourished and 26% of the patients had severe malnutrition. A significant relationship between tools and anthropometry was only found between TST and SGA ($p<0.05$).

**Conclusion:** Malnutrition prevalence among oncology patients seems to be significant and screening is important for prevention and intervention. Both NRS-2002 and SGA tools are useful and consistent for screening malnutrition.

**Keywords:** Malnutrition, cancer, NRS-2002, SGA

**ÖZEL BİR HASTANEDE YATAN YETİŞKİN KANSER HASTARINDA MALNUTRİSYON PREVALANSI VE TARAMA ÖLÇEKLERİ İLE ANTROPOMETRİK ÖLÇÜMLERİN TUTARLILIĞI: KESİTSEL ÇALIŞMA**

**ÖZET**

**Amaç:** Malnutrisyon kanser hastalarında sıklıkla görülen bir komplikasyondur ve morbidite ve mortaliteyi etkileyebilmektedir. Bu nedenle, beslenme durumun değerlendirilmesi ve malnutrisyon taraması hem korunma hem de müdahale açısından gereklidir. Bu kesitsel çalışmada, yetişkin onkoloji hastalarında malnutrisyon prevalansının değerlendirilmesi ve iki farklı malnutrisyon tarama ölçeğinin ve antropometrik ölçümlerin karşılaştırması amaçlanmıştır.

**Yöntem:** Çalışma 7 Ocak – 7 Nisan 2016 tarihleri arasında özel bir hastanede 59 kişi ile yürütülmüştür. Hastanın hastaneye yatışını takip eden ilk 48 saat içinde malnutrisyon taraması ve ölçümler gerçekleştirilmiştir. Malnutrisyon taraması için Nutritional Risk Screening-2002 (NRS-2002) ve Subjective Global Assesssment (SGA) ölçekleri, antropometrik değerlendirmede beden kütle indeksi (BKİ), deri kıvrım kalınlığı (DKK) ve üst orta kol çevresi (ÜOKÇ) kullanılmıştır.

**Bulgular:** NRS-2002 sonuçlarına göre hastaların %41'inin beslenme riski taşıdığı ve sonucun SGA ile uyumlu olduğu saptanmıştır ($p<0,05$). SGA sonuçlarına göre hastaların %15'inin orta derecede malnutrisyonlu, %26'sının şiddetli malnutrisyonu olduğu görülmüştür. Ölçekler ile antropometrik ölçümler arasında anlamlı ilişki sadece DKK ve SGA arasında bulunabilmiştir ($p<0,05$).

**Sonuç:** Onkoloji hastalarında malnutrisyon prevalansı yüksektir ve hem korunma hem müdahale için malnutrisyon taraması önemlidir. NRS-2002 ve SGA malnutrisyon taraması için kullanışlı ve birbirleri ile uyumlu ölçeklerdir.

**Anahtar sözcükler:** Malnutrisyon, kanser, NRS-2002, SGA

## Introduction

Disease related malnutrition is a common and frequent problem and is related to high mortality and morbidity risk. It has been found that approximately 30% of hospitalised patients have malnutrition and a great majority have malnutrition before hospitalisation (1). As malnutrition worsens during the hospital stay, early screening and assessment of nutritional status are crucial for prevention and intervention. Malnutrition destroys immune functions and makes the patients more prone to infectious diseases. It is also related to a prolonged hospital stay and increased financial costs (2–4).

Malnutrition might be seen in any period of cancer including the diagnosis stage. Both cancer and its treatment may cause malnutrition in those patients (5). In case of malnutrition, treatment intolerance may occur and morbidity and mortality rates increase and quality of life diminishes (6). It has been reported that 50% of the patients have already lost 5% of their weight before diagnosis and 20% of the patients with cancer died because of malnutrition. (7). Patients with cancer are the group having the poorest nutritional status among all hospitalized patients (4). Malnutrition may be both cause and result of the disease and for cancer outpatients, it is as high as hospitalized ones (8, 9).

Screening malnutrition risk is crucial to overcome it. After the nutritional screening, patients with high risk need a detailed nutritional assessment which is the next step. Patients who are identified to be at nutritional risk according to any nutritional screening tool, require a detailed nutritional assessment. Nutritional assessment should contain the following principles: – the assessment of nutritional balance – the assessment of body composition – the assessment of inflammatory activity – the assessment of body functions (8). There are universal screening tools for malnutrition screening of which one is Nutritional Risk Screening-2002 (NRS-2002). NRS-2002 searches for decreased body mass index (BMI), decreased nutrient intake, and weight loss. It also takes into account the severity of the relevant disease by considering metabolic stress and the increase in nutritional needs in its subjective assessment part (1).

Subjective Global Assessment (SGA) includes weight changes, alterations in dietary intake, functional capacity, and gastrointestinal symptoms. It also questions if there are edema and ascites and assesses fat and muscle stores (1).

Anthropometry shows the anatomical changes related to nutrition (8). It is an indicator of protein and fat stores. BMI, the most common component of anthropometry is calculated with the formula of weight (kg)/(height$^{2)}$ ($m^2$) (10).

Mid upper arm circumference (MUAC) is a good indicator reflecting patients' nutritional status among other anthropometric measurements. It predicts lean muscle mass and it is widely used in nutritional assessment (11). There are studies implying that low MUAC level is correlated with increased mortality risks, and low quality of life (12). When MUAC and triceps skinfold thickness (TST) are used together, they predict the muscle and fat mass better. The assumption of measuring skinfold thickness is that subcutaneous fat mass thickness is a constant percentage of total fat mass in the body (8). In this cross-sectional study, we aimed to evaluate malnutrition prevalence among adult cancer patients and compare two screening tools and anthropometric measurements.

## Material and Method

### *Participants*

The study was conducted on hospitalized adult cancer patients between 7th of January– 7th of April in 2016 in a private hospital. Along the study timeline, 433 adult patients were admitted to the hospital's oncology and haematology inpatient clinic. Totally, 59 of those 433 patients could be included in the study as a great majority of them were in the terminal period, therefore they had to be excluded from the study according to the including criteria and the remained ones were not voluntary to participate in. A written informed consent form was obtained from every participant and patients older than 18 years old with any type of cancer were included in the study. Immobile patients and patients at a terminal stage were excluded from the study if it was impossible to take anthropometric measurements.

### *Data collection*

data were collected within 48 hours following hospitalisation and before nutritional intervention regarding malnutrition. Malnutrition screening tools, Nutritional Risk Scoring (NRS)-2002 and Subjective Global Assessment (SGA) were used. NRS-2002 was developed by Kondrup and colleagues in 2002 (13). It consisted of two parts. One part focuses on nutrition and the other on the severity of the disease. As the first step, the tool questions if the body mass index (BMI) of the patient is <20.5; there has been a weight loss in the last 3 months; there is a decrease in nutrient intake in the last week, and the patient's disease is severe or not. If any of those questions' answers is yes, the person applying for the test passes to the scoring part. In the part related to nutrition BMI, weight loss percentage and nutrient intake are questioned. The patients applying to the test scores are those between 0 and 3.0 means there isn't any nutritional problem. In the part related to disease severity, the patient applying to the test has to

score a disease severity between 0–3. Score 1 indicates the patients having a chronic disease such as cancer and complications related to this disease. Score 2 indicates immobile patients as a result of a major abdominal surgery or infection, and score 3 is used for intensive care patients and patients under ventilation support (1).

SGA is another popular nutritional assessment tool. It includes parts questioning weight change, alterations in dietary intake, the functional capacity of the person and gastrointestinal symptoms. It also questions if edema and ascites occur, and it assesses fat and muscle stores (1). It categorizes patients into 3 groups which are A: well-nourished B: moderately malnourished C: severe malnutrition. SGA is found as a good tool in detecting malnutrition in inpatient groups (14).

Patients' weight and height were measured by a digital scale (Seca 767) and their height was measured with a stadiometer attached to it. With the formula of kg/m$^2$, the BMI of patients was calculated and classified according to BMI classification of the World Health Organisation (WHO). Mid upper arm circumference (MUAC) was measured by using an inelastic tape. While the patient is lying on one side, the arm on another side was put on the body and the palm was at an open position. When the patient was at this position, the middle point between shoulder prominence (acromion) and elbow prominence (olecranon) was marked with a pen and the circumference of this point was measured with the tape and recorded in centimeters. Measurements were taken from the right or left arm depending on the patient's medical conditions.

Triceps skinfold thickness (TST) was measured at one finger above from the midpoint between acromion and olecranon with Holtain Skinfold Caliper. The measurement was repeated for three times and the average of them was taken. MUAC and TST values were categorized according to the National Center for Health Statistics (NCHS).

### *Statistical analysis*

In the analysis of the study, SPSS v22.0 was used. In group comparisons, chi-square test and variance analysis (one-way ANOVA) were used. In relationship analysis, the Pearson correlation coefficient was used. P-value <0.05 was accepted as statistical significance.

### *Ethical approval*

All study procedures were approved by the Research Ethics Committee at Acıbadem University on 24.12.2015 with the approval number of 2015–15/6.

## Results

The mean age of the participants was 56.05 ( ±15.03). 47.5% were women (n=28) and 52.5% were men. Cancer types were as follows: 39% hematologic cancers, 19% gastrointestinal cancers 14% with gynecologic cancers and other types were respiratory system cancers; breast cancers; head and neck cancers; Musculoskeletal cancers; genitourinary system cancers.

NRS-2002 scores found that 41% of the patients were under nutritional risk (NRS-2002 score ≥3) and the remaining 59% should be screened once a week (NRS-2002 score <3). When the patients were categorized according to their SGA results; the percentages of the groups were as follows: 59% well nourished (SGA-A), 15% moderately malnourished (SGA-B), and 26% had severe malnutrition (SGA-C). The general characteristics of the patients are shown in Table 1. The relationship between NRS-2002 and SGA is found statistically significant (p: 0.020, p<0.05).

**Table 1**. General characteristics of the patients*

| | *Number (n)* | *Percentage (%)* |
|---|---|---|
| **Sex** | | |
| Women | 28 | 47.5 |
| Men | 31 | 52.5 |
| **Diagnosis** | | |
| Hematologic cancer | 23 | 39.0 |
| Gastrointestinal system cancer | 11 | 18.6 |
| Gynecologic cancer | 8 | 13.6 |
| Respiratory system cancer | 7 | 11.9 |
| Breast cancer | 4 | 6.8 |
| Head and neck cancer | 3 | 5.1 |
| Musculoskeletal cancer | 2 | 3.4 |
| Genitourinary system cancers | 1 | 1.7 |
| **BMI*** | | |
| <18.50 | 5 | 8.6 |
| 18.50–24.99 | 23 | 39.7 |
| 25.00–29.99 | 20 | 34.5 |
| ≥30.00 | 10 | 17.3 |
| **NRS-2002 Score*** | | |
| ≥3 | 24 | 41.4 |
| <3 | 34 | 58.6 |
| **SGA*** | | |
| A | 34 | 58.6 |
| B | 9 | 15.5 |
| C | 15 | 25.9 |

*This study was conducted with 59 patients. There were missing data in the study in that MUAC and TST could not be measured for 12 patients because they delayed or refused the measurements, therefore only NRS-2002 and SGA were applied to those patients. Also, one of the patient's MUAC and TST was measured but other anthropometric measurements could not be taken because the patient was immobile at that moment.

Patients under nutritional risk (NRS-2002 score ≥3) also had severe malnutrition according to SGA (C), and the ones that did not carry any nutritional risk according to NRS-2002 were the well nourished ones according to SGA. In the correlation analysis between methods, there is a negative and significant relationship between NRS-2002 and SGA. Patients who had moderate or severe malnutrition according to SGA also had malnutrition if screened with NRS-2002.8.6% of the patients were underweight, while 34.5% were overweight and 17.3% were obese with a BMI ≥30 kg/m$^2$**.**22.7% of the patients were at <5th percentile of MUAC categorization and 6.8% of them were at <5th percentile of TST categorization.

Age was not significantly associated with BMI, NRS-2002, SGA, weight loss in last 3 and weight loss in last 6 months (p=0.289; 0.760; 0.656; 0.178 respectively, p>0.05).

A statistically significant relationship among sex was only found with SGA categories. According to SGA, the number of well nourished women was higher than men (p: 0.011; p<0.05).

The association between cancer type and both NRS-2002 and SGA results were statistically significant (p: 0.021; p: 0.006 respectively, p<0.05). The patients at malnutrition risk were commonly the ones with gastrointestinal system cancers.

The relationship between MUAC, TST and NRS-2002 was not statistically significant (p: 0.372, p: 0.178 respectively, p>0.05). The patients that do not carry any nutritional risk had higher MUAC and TST, even if the relationship was not significant. When the relationship between MUAC and SGA was analyzed, there was not any significant relationship between them (p: 0.369). The relationship between triceps skinfold thickness and SGA was significant (p: 0.000, p<0.05). The patients who did not carry any malnutrition risk had higher TST.

BMI values but not classes were significantly different among NRS-2002 groups. Patients who did not carry any nutritional risk (NRS-2002 score <3) had higher BMI values (p: 0.014, p<0.05); however, according to BMI classification of WHO, the result was not statistically significant (p: 0.163, p>0.05).

The relationship between BMI and SGA did not show significant differences between both BMI averages and classes (p: 0.291; p: 0.125 respectively, p>0.05) while the highest BMI value is seen in the well-nourished group and the lowest value is seen in the patients with severe malnutrition. The correlation analysis between tools is summarised in Table 2.

## Discussion

When the patients were screened for malnutrition with NRS-2002, the nutritional risk among cancer patients was 41%. In another study conducted by a group of researchers with 1453 cancer patients, the patients' nutritional status was screened by using NRS-2002. According to the study, 32% of those patients were under nutritional risk (NRS-2002 score ≥3) (15). In our study, 59% of the patients were well nourished according to SGA (SGA-A), 15% were moderately malnourished (SGA-B) and 26% of them

**Table 2**. Correlation analysis between tools

| | *Diagnosis* | *Age* | *BMI* | *WL[1] (3 m)* | *WL[2] (6 m)* | *NRS-2002* | *SGA* | *MUAC* | *TST* |
|---|---|---|---|---|---|---|---|---|---|
| **Diagnosis** | | | | | | | | | |
| **Age** | -0.037 | | | | | | | | |
| **BMI** | 0.185 | 0.213 | | | | | | | |
| **WL[1] (3 m)** | 0.484** | 0.116 | 0.070 | | | | | | |
| **WL[2] (6 m)** | 0.279* | 0.057 | 0.042 | 0.829** | | | | | |
| **NRS-2002** | -0.136 | 0.041 | 0.286* | 0.086 | 0.000 | | | | |
| **SGA** | -0.472** | -0.104 | -0.204 | -0.360** | -0.146 | -0.361** | | | |
| **MUAC** | 0.195 | -0.030 | 0.785** | 0.150 | 0.122 | 0.225 | -0.057 | | |
| **TST** | 0.353* | -0.115 | 0.462** | 0.278 | 0.298 | 0.101 | 0.049 | 0.567** | |

[1]Weight loss in last 3 months.
[2]Weight loss in last 6 months.
*p<0.05
**p<0.01

had severe malnutrition (SGA-C). The malnutrition prevalence differ between 15% and 78% (1, 9, 16–19) in recent research. We found that cancer type and both NRS-2002 and SGA results were statistically significant and in a relationship ($p<0.05$) and the patients at greater malnutrition risk were commonly the ones with gastrointestinal system cancers as nutritional intake, digestion and absorption may also be involved additionally to cancer progression. According to a study conducted by Gundogdu and colleagues, 107 patients with gastrointestinal system cancer were assessed by using NRS-2002 and SGA. The patients having an NRS-2002 score ≥3 and the patients having an SGA score of B and C were accepted as under nutritional risk. According to that study, 72% of the patients were under nutritional risk according to NRS-2002, and 78% of them were under nutritional risk according to SGA (19). In previous studies aiming to evaluate malnutrition prevalence among oncology patients by using NRS-2002 and SGA, malnutrition rates changed between 15% and 78% (1, 17–20). The differences may be related to different patients with different diseases having different pathologies. The reason for a high rate of malnutrition might be due to the fact that our study was conducted in a medical oncology treatment service in which the patients' complications increased.

When it comes to the concordance between NRS-2002 and SGA; in our study, there was a significant relationship between NRS-2002 (NRS-2002 score ≥3) and SGA (SGA B and C) in that the patients that do not have a nutritional risk are the well-nourished ones according to SGA ($p<0.05$). In a study conducted by Ozturk and his/her colleagues, 603 patients were assessed by NRS-2002 and SGA at hospital admission. There was a significant difference between NRS-2002 and SGA results as a result of the chi-square test ($p<0.001$). There was a 66.2% concordance between the patients at malnutrition risk according to NRS-2002 and the patients with malnutrition or having malnutrition risk according to SGA. However, 33.8% of the normal patients according to SGA were at malnutrition risk (19). In another study conducted by Leandro-Merhi VA and Brage de Aqino, 500 patients with cancer or gastrointestinal tract diseases were assessed by using NRS and SGA and anthropometric measurements. According to the study, there was a good agreement between NRS-2002 and SGA, but the agreement of those with anthropometry was poor (20). One of the aims of our study was to evaluate the accuracy between NRS-2002 and SGA in detecting malnutrition. We found the same malnutrition prevalence in both; according to NRS-2002, it was 41% and a 41% total (15% moderate and 26% severe malnutrition) with SGA.

In another study investigating the role of SGA in nutritional assessment, 751 patients with gastrointestinal cancer were assessed with SGA and their anthropometric measurements were taken. According to the results, 51.8% of the patients were well nourished (SGA-A), 44.2% of the patients were with mild/moderate malnutrition (SGA-B) and 4% of the patients were in the severely malnourished group (SGA-C). The relationship analysis between SGA and anthropometry showed that the patients with severe malnutrition are the ones having lower BMI values, and TST levels and vice versa ($p<0.05$) (16). In our study, 59% of the patients were in the SGA-A category, 15% of the patients were in the SGA-B group and 26% of the patients were in the SGA-C group. In contrast to this study, we did not find any significant relationship between SGA categories and BMI values of the patients. And similar to that, we found a significant relationship between SGA-category and triceps skinfold thickness. In our study, we evaluated the relationship between SGA categories with both BMI values of the patients and BMI categories of WHO. We could not find any significant relationship between SGA and BMI. Also, in another study conducted by Almeida and his/her colleagues, 300 surgical patients were assessed at hospital admission with NRS-2002, SGA, Malnutrition Universal Screening Tool (MUST), Nutritional Risk Score (NRI), BMI and percentage of weight loss. The comparison was made by using BMI categories of WHO, and the lowest agreement between methods was the one between BMI and SGA (21). Also in another study conducted by Baccaro and Sanchez, SGA and BMI were compared in detecting the nutritional status of male patients admitted to a medical service. According to the SGA, 48.7% of patients were malnourished (SGA B and SGA C). According to BMI results, only 9.9% of the patients were malnourished. There wasn't any association found between SGA and BMI (22). We concluded that the concordance between SGA and BMI was not good enough in predicting malnutrition.

We could not found any significant relationship between malnutrition status comparing NRS-2002 scores with MUAC percentiles of the patients. In China, 142 surgical elderly patients' nutrition was assessed by using two tools one of which was NRS-2002 and anthropometry. According to the research, as malnutrition severed according to NRS-2002, the mid-arm circumference of the patients decreased ($p<0.05$) (23). Another study aiming to detect the malnutrition prevalence in hospitalized patients also compared NRS-2002 and MUAC. They could not find a statistically significant association between NRS-2002 and MUAC. The relationship between NRS-2002 and TST was not significant also (7).

In our study, there wasn't a significant relationship between MUAC and SGA groups. In a prospective cohort study conducted with 1022 adult inpatients in Canada, patients were assessed by using SGA, NRS-2002, and anthropometry. MUAC was one of the anthropometric measurements to detect malnutrition. MUAC did not differ between SGA groups (SGA-A, SGA-B, and SGA-C) (24).

When the relationship between BMI and NRS-2002 is evaluated in our study, there was not a significant relationship between them when the patients were categorized according to WHO's BMI classification ($p>0.05$). However, there was a significant relationship between NRS-2002 scores and BMI values of the patients, in that the patients who do not have a malnutrition risk had higher BMI values compared to the ones having malnutrition risk ($p<0.05$). SGA scores and BMI showed no significant relationship both with values and classes. In a study conducted by Borek and colleagues, 292 inpatients with chronic kidney diseases were nutritionally assessed by using NRS-2002, SGA and anthropometric measurements. 119 (41%) of the patients were at malnutrition risk according to NRS-2002. According to SGA, the risk was 41% (SGA B and C) but only 8.4% of the malnourished patients had a BMI of less than 18.5, therefore it was concluded that BMI was not competent to assess the nutritional status of inpatient groups (25).

NRS-2002 and SGA tools are useful and consistent for screening malnutrition. BMI values but not classes are accurate with malnutrition screened with NRS-2002. TST is the only anthropometric measurement consistent with SGA. Malnutrition prevalence among oncology patients seems to be significant and screening is important for prevention and intervention.

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