Original Article

Determination of the effectiveness of the three-minute nutrition screening (3-MinNS) tool in adult patients hospitalized in a cardiology clinic

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ABSTRACT

الأهداف: تهدف هذه الدراسة إلى تحديد مدى فعالية أداة فحص التغذية لمدة دقائق (3–MinNS) لدى البالغين الذين يدخلون المستشفى بسبب أمراض القلب والأوعية الدموية .المرضى الذين يعانون من أمراض القلب والأوعية الدموية (CVDs) معرضون لخطر سوء التغذية. لذلك، يجب فحص المرضى بحثًا عن خطر سوء التغذية في اليوم الأول من دخول المستشفى باستخدام فحص تغذية بسيط وسريع وصالح وموثوق (NST).

المنهجية: في هذه الدراسة الوصفية المقطعية المستعرضة، تم تسجيل القياسات الأنثروبومترية وبعض المعايير الكيميائية الحيوية الروتينية لـ 759 مريضًا من مرضى الأمراض القلبية الوعائية في عيادة أمراض القلب بجامعة إرجييس، وتم استخدام تقنية قياس سوء التغذية لتحديد حالة سوء التغذية وتم حساب قوة 3–MinNS للكشف عن سوء التغذية لدى مرضى الأمراض القلبية الوعائية.

النتائج: كانت هناك علاقه ايجابيه قويه بين أداءه الثلاث دقائق 3–MinNS وNRS–2002، حيث كانت (r=0.719، *p*<0.001). تم العثور على اتفاق معتدل بين 3–MinNS وNRS–2002 حيث كانت (κ=0.496, *p*<0.001). كانت الحساسية 79.1% و النوعية و75% والمساحةو0.851% لل 3–MinNS وقد تم تحديده على أنه اختبار NST فعال إلى حد ما ويمكن استخدامه لتحديد سوء التغذية لدى المرضى الذين يعانون من الأمراض القلبية الوعائية.

الخلاصة: 3–MinNS يعتبر NST فعال إلى حد ما ويمكن إعطاؤه خلال الـ 24 ساعة الأولى من دخول المستشفى للمرضى الذين يعانون من الأمراض القلبية الوعائية.

Objectives: To determine the efficacy of the 3-Minute Nutrition Screening (3-MinNS) tool in adults hospitalized for cardiovascular diseases.

Methods: In this descriptive cross-sectional study of 759 cardiovascular disease patients in Erciyes University Cardiology Clinic, anthropometric measurements and some routine biochemical parameters were recorded, and nutrition screening tools were used to determine malnutrition status. The power of 3-MinNS to detect malnutrition in cardiovascular diseases patients was calculated.

Results: There was a strong positive correlation between 3-MinNS and Nutrition Risk Screening-2002 (NRS-2002) (r=0.719, *p*<0.001). A moderate agreement was found between 3-MinNS and NRS-2002 (κ=0.496, *p*<0.001). The sensitivity, specificity, and AUC of 3-MinNS were 79.1%, 75.0%, and 0.851, respectively, and it was determined to be a moderately effective nutrition screening tool that can be used to identify malnutrition in patients with cardiovascular diseases.

Conclusion: The 3-MinNS is a moderately effective nutrition screening tool that can be administered within the first 24 hours of hospitalization in patients with cardiovascular diseases.

Keywords: 3-MinNS, NRS-2002, nutrition screening tool, malnutrition, cardiovascular disease, cardiology

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The condition known as cardiovascular diseases (CVDs) impairs blood flow to the heart, brain, and other peripheral body components. These comprise rheumatic heart disease, cerebral vascular disease, coronary heart disease, congenital heart disease, and peripheral vascular disease.[1] Cardiovascular disease is a leading cause of morbidity and mortality in Europe. Over 6 million new cases of CVD are reported in the European Union each year, and over 11 million new cases are reported throughout Europe, according to the European Society of Cardiology's (ESC) Atlas of Cardiology.[2] Despite the decreasing trend in mortality associated with CVDs, approximately half of all deaths in most European countries continue to be attributable to CVD.[3]

In patients with CVD, increased basal metabolic rate due to cardiac load, respiratory load, and increased peripheral oxygen consumption, along with decreased energy expenditure, may trigger the catabolic process leading to cardiac cachexia (CC). Cardiac cachexia is defined as an involuntary loss of 6% or more of a patient's dry weight within 6 months.[4,5] While CC was first described in patients with heart failure, it has recently been observed to occur in other areas such as peripheral arterial disease, atrial fibrillation, coronary artery disease and also in patients with CVD after cardiac surgery or transcatheter aortic valve implantation.[6-8] It is estimated that 5–15% of patients with advanced CVD have CC. CC is considered a serious complication with a poor prognosis.[9] The European Society for Clinical Nutrition and Metabolism (ESPEN) has established guidelines that identify chronic inflammation-related malnutrition to CC as the same as disease-related malnutrition.[10,11] Hence, malnutrition should be prevented to protect patients with CVD against CC.[6]

Malnutrition is a condition that results from inadequate intake or absorption of nutrients leading to a decrease in body composition (especially a decrease in fat-free mass), changes in body cell mass, and a reduction in physical and mental functioning, leading to disease.[11] In the European population, the prevalence of malnutrition increases with age and ranges from 10% to 29%.[12,13] The incidence of malnutrition in individuals with CVD is between 8-57%, according to the level of severity.[14] The presence of malnutrition in patients with CVD increases the risk of mortality by 2 to 10 times.[15]

Even though the high prevalence and outcomes of malnutrition during hospital admission, malnourished patients are often not identified, and approximately 70% of these patients do not receive any nutritional treatment. The nutritional status of patients deteriorates further when no nutritional treatment is applied after hospital admission.[16] It should be aimed to ensure the place of nutrition in the treatment of CVD and diet adaptation, and to protect against CC with nutritional support therapies when necessary.[5] Given that malnutrition is often unidentified, untreated, and increases the risks of morbidity and mortality, it is important to systematically screen hospitalized patients using a simple, rapid, reliable, and valid method.[17,18] In order to identify patients with malnutrition, their nutritional status should be screened with appropriate methods during admission and hospitalization.[19]

Recently, a core leadership committee comprising representatives of several global clinical nutrition associations (American Society for Parenteral and Enteral Nutrition [ASPEN], ESPEN, Parenteral and Enteral Nutrition Society of Asia [PENSA], Latin American Federation of Nutritional Therapy, Clinical Nutrition and Metabolism [FELANPE]) reached a consensus on Diagnostic Criteria for Malnutrition (DCM). The Global Leadership Initiative on Malnutrition (GLIM) recommends a 2-step approach that includes screening for malnutrition risk (Step 1) followed by assessment for diagnosis (Step 2).[20] There is no international consensus on the most appropriate nutritional screening tool (NST) or appropriate combinations to predict mortality; however, a good NST should be simple and easy to use, use routinely collected data, be cost-effective, reliable, and valid.[21,17,18] The 3-Minute Nutrition Screening (3-MinNS) tool, developed for adult hospitalized patients in Singapore, incorporates established risk factors for malnutrition. It is non-invasive, simple, and quick to administer (less than 3 minutes), utilizes existing data, and determines nutritional status with minimal data loss. Thus, it encompasses all the characteristics of an NST.[22]

Malnutrition in CVD is associated with length of hospitalization, morbidity, and mortality.[23] Therefore, hospitalized patients should be screened for nutritional status within the first 24 hours.[24] The fact that 3-MinNS is a rapid, simple, valid, and dependable NST will provide great convenience and time savings in determining malnutrition. In this context, this study aimed to determine the validity and efficacy of 3-MinNS in predicting malnutrition in adult patients with CVD receiving inpatient treatment in a tertiary cardiology hospital.

Methods. This descriptive cross-sectional study was carried out between January 2023 and August 2023 with patients hospitalized in the cardiology service of Erciyes University Faculty of Medicine, Heart, and Vascular Hospital, Kayseri, Turkey for any CVDs. The

Erciyes University Clinical Research Ethics Committee granted approval for the study. In compliance with the Declaration of Helsinki's tenets, persons with CVD provided written informed consent, and study participants who volunteered were also included.

The study's sample size was calculated to be approximately 125 patients with CVDs to obtain a 95% confidence interval based on 2 previous studies showing that 3-MinNS has a sensitivity and specificity of 85%.[22,25] The study was completed with 759 patients with CVDs, the maximum number of patients who could be reached within the specified period.

The study included patients who were treated in a cardiology hospital, were over the age of 18, were conscious, and could speak. Patients younger than 18 years of age, with a loss of consciousness or communication problems, patients with any limb loss, and in the terminal period were excluded. Demographic information was obtained with a questionnaire, anthropometric measurements (height, weight, neck circumference [NC], mid-upper arm circumference [MUAC]) were measured by the investigator, and some routine biochemical parameters (total protein, albumin) were recorded. Nutrition Risk Screening-2002 (NRS-2002) and 3-MinNS NST assessed nutritional status in the first 24 hours after hospitalization.

A scale with an accuracy of 0.1 kg was used to measure weight, and a non-flexible tape measure was used to measure height. Weight measurements were made in thin clothes and on an empty stomach in the morning, and height measurements were made without shoes on the Frankfort horizontal plane.[26] After measuring the weight (kg) and height (m) of the participants, body mass index (BMI) (kg/m^2) values were calculated according to the formula (weight [kg]/ height^2 [m]). The World Health Organization (WHO) BMI classification for adults divided BMI values into 5 categories: <18.5 kg/m^2 underweight, 18.5-24.9 kg/m^2 normal weight, 25.0-29.9 kg/m^2 overweight, 30.0-34.9 kg/m^2 obesity class I, 35.0-39.9 kg/m^2 obesity class II, and ≥40 kg/m^2 obesity class III.[27] The patients were in the Frankfort plane, with their feet together, their eyes and ears aligned, and their shoulders relaxed. Neck circumference was measured from the middle of the neck, between the middle cervical spine and the middle anterior neck.[28] With the arm 90 degrees bent at the elbow, the MUAC was measured at the halfway point between the olecranon process and the acromial process of the shoulder.[26]

Nutrition risk screening-2002 was used as the reference standard to assess the validity and reliability of 3-MinNS in patients with CVDs. Nutrition risk screening-2002 is an NST that scores the deterioration in nutritional status and disease severity of patients. This form consists of 2 parts. In the first part (initial screening), the severity of the disease, weight loss over 3 months, and decreases in food intake over 3 months are questioned. When the answer to all questions is "No" the second part is not started, and weekly scans are continued. When the answer to any of the questions is "Yes" the second part starts (final screening), and patients are evaluated regarding nutritional deficiency and disease severity. Patients with an NRS-2002 score of ≥3 are at risk of malnutrition.[29]

Three-MinNS is an NST used to assess three nutritional parameters. These include involuntary weight loss in the last 6 months, food intake, and muscle loss in the temple and clavicle. A checkbox method assigns a quantitative score from 0 to 3 to each criterion, with the most severe being indicated by a score of 3. Patients with a risk score of 3 or more are defined as at risk of malnutrition. Scores between 3 and 4 indicate moderate malnutrition, and scores between 5 and 9 indicate severe malnutrition.[22]

Statistical analysis. The Statistical Package for the Social Sciences Statistics for Windows, version 25 (IBM Corp., Armonk, N.Y., USA), was used to examine the data that had been gathered. For every statistical analysis, $p<0.05$ was used as the significance level.

To determine if the distribution of quantitative variables was normally distributed, the Kolmogorov-Smirnov test was employed. The statistical data that did not exhibit a normal distribution were expressed as median (minimum-maximum), while the data that did exhibit a normal distribution were expressed as mean ± standard deviation ($\bar{x}$ ± SD). When comparing quantitative data with a normal distribution, the independent-sample T-test was employed, and when comparing data without a normal distribution, the Mann-Whitney U test was utilized. Categorical variables were subjected to the Chi-square test. Using Pearson correlation analysis, the 2 quantitative data sets' agreement was assessed. Pearson correlation coefficients were interpreted as follows: -0.29 to -0.10 negative, weak correlation; -0.49 to -0.30 negative, moderate correlation; -0.50 to -1.00 negative, strong correlation; and 0.10 to 0.29 positive, weak correlation; 0.30 to 0.49 positive, moderate correlation; 0.50 to 1.00 positive, strong correlation.[30] Cohen's κ coefficient was used to analyze the agreement between the 3-MinNS and was interpreted following the Altman classification, which considers the κ coefficient of; 1 to 0.81 as very good, 0.80 to 0.61 as good, 0.60 to 0.41 as moderate, 0.40 to 0.21 as fair, and ≤0.20 as poor.[31] A contingency table was used to determine the sensitivity, specificity, and predictive values of 3-MinNS in detecting patients at risk of malnutrition, which were compared with the NRS-2002 as the reference standard. Three-MinNS diagnostic parameters (sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV), positive likelihood ratio, negative likelihood ratio) were calculated using Excel software and expressed as percentages. The performance of 3-MinNS in determining nutritional risk is shown by the receiver operating characteristic (ROC) curve and area under the curve (AUC) (c –statistic). Results of the c-statistic were interpreted according to the following criteria, previously proposed to assess the validity of the 3-MinNS; 0.50 to 0.59 poor, 0.60 to 0.69 moderate, 0.70 to 0.79 good, 0.80 to 0.89 very good, and ≥0.90 excellent discrimination.[32] The success of 3-MinNS in detecting malnutrition was graded as good, fair, or poor according to the cut-off values proposed by the MaNuEL Consortium. An NST was classified as "good" if both sensitivity and specificity were > 80% and AUC was >0.8, "fair" if sensitivity or specificity were < 80% but both were >50%, and AUC was in the range of 0.6–0.8; and "poor" if sensitivity or specificity was <50% and AUC was < 0.6.[33]

Results. Seven hundred fifty-nine patients with CVDs, 57.6% males and 42.4% females, were included in the study, and the mean age was 63.80 ± 13.26 years.

Some characteristics of the participants according to NRS-2002 and 3-MinNS are shown in Table 1. According to NRS-2002, a statistically significant difference was found between low and severe-risk groups in terms of age, age group, BMI, BMI group, MUAC (for all p<0.001), NC (p=0.001), total protein (p=0.002), and albumin (p=0.002). A statistically significant difference was found between 3-MinNS low and medium/severe risk groups in terms of age, age group, BMI, BMI group, NC, MUAC, albumin (for all p<0.001), and total protein (p=0.002).

The correlation of NSTs with some parameters is shown in Table 2. Three-MinNS score: It showed a negative, weak correlation with NC, total protein, and albumin values; a negative, moderate correlation with BMI and MUAC; and a positive, weak correlation with age (p<0.001). NRS-2002 score: it showed a negative, weak correlation with BMI, NC, MUAC, total protein, and albumin values and a positive, weak correlation with age (p<0.001). There was a positive, strong correlation between the scores of 3-MinNS and NRS-2002 (r=0.719, p<0.001).

A moderate statistically significant agreement was found between 3-MinNS and NRS-2002 (κ=0.496, p<0.001).

The diagnostic parameters of 3-MinNS are shown in Table 3. The sensitivity 79.1%, specificity 75%, PPV 59.3%, NPV 88.6%, positive likelihood ratio 3.163, and negative likelihood ratio 0.279 of 3-MinNS.

The ROC curve in Figure 1 illustrates the performance of 3-MinNS in predicting nutritional risk. When 2 observations are randomly selected, the test result of an observation with the disease is 85.1% more likely to be positive than an observation without the disease (AUC=0.851, p<0.001).

When the success of 3-MinNS in detecting malnutrition in patients with CVD was analyzed according to the cut-off values recommended by the MaNuEL Consortium, 3-MinNS was determined to be a moderately effective NST that can be used in patients with CVD since its sensitivity was 79.1%, specificity was 75%, and AUC value was 0.851.

Discussion. The prevalence of malnutrition among hospitalized adults is reported to be 25% to 40% worldwide. It has been found that most of these individuals do not receive any nutritional intervention during their hospitalization.[16,34,35] Considering that malnutrition is often unrecognized and untreated and increases the risks of morbidity and mortality, it is important to systematically screen hospitalized patients using a simple, rapid, reliable, and valid method.[17,18]

An NST typically includes anthropometric measurements, pre-admission psychosocial risk factors, and self-reported parameters such as body weight loss and appetite history.[24] These are widely used because they are the most economical and accessible parameters.[11] Individuals with CVD experience rapid weight changes, particularly in heart failure, because of changes in fluid volume brought on by a worsening disease course or therapeutic responses. This results in incorrect BMI calculations and makes it challenging to evaluate subclinical volume change body weight change in people with CVD.[36] In addition, NSTs such as NRS-2002 and Malnutrition Universal Screening Tool (MUST) include parameters such as BMI that require measurement of body weight, height, or knee height to determine malnutrition.[29] Appropriate equipment is required for the accurate measurement of these parameters. The accurate calculation of the BMI of bedridden, weak, or elderly patients prevents NSTs from giving accurate results due to a lack of appropriate equipment and ignorance of equipment use.[22] In addition, the high number of patients and

Table 1 - Characteristics of the participants.

Variables	Nutrition Risk Screening-2002 No/Low risk	Severe risk	*P*-value
Age Group n (%)			
<65 year	286 (55.0)	61 (25.5)	<0.001
≥65 year	234 (45.0)	178 (74.5)	
Age (year) (x̄±SD)	61.43 ± 13.07	68.97 ± 12.16	<0.001
Gender n (%)			
Male	299 (57.5)	138 (57.7)	0.950
Female	221 (42.5)	101 (42.3)	
BMI (kg/m^2)	28.10 (15.80-49.60)	26.10 (16.90-46.60)	<0.001
BMI group n (%)			
Underweight	5 (1.0)	3 (1.3)	<0.001
Normal weight	107 (20.6)	91 (38.1)	
Overweight	204 (39.2)	79 (33.1)	
Obesity class I	135 (26.0)	48 (20.1)	
Obesity class II	50 (9.6)	14 (5.9)	
Obesity class III	19 (3.7)	4 (1.7)	
NC (cm)	39.0 (16.0-56.0)	38.0 (19.0-59.0)	0.001
MUAC (cm)	31.0 (20.0-48.0)	28.0 (16.0-43.0)	<0.001
Total protein (g/dL)	6.70 (2.0-8.93)	6.46 (1.66-8.45)	0.002
Albumin (g/dL)	3.95 (0.90-7.94)	3.83 (2.0-7.0)	0.002
Age group n (%)			
<65 year	239 (54.3)	108 (33.9)	<0.001
≥65 year	201 (45.7)	211 (66.1)	
Age (year) (x̄±SD)	61.89 ± 13.30	66.45 ± 12.76	<0.001
	Three-Minute Nutrition Screening		
Gender n (%)			
Male	258 (58.6)	179 (56.1)	0.487
Female	182 (41.4)	140 (43.9)	
BMI (kg/m^2)	28.70 (18.0-47.10)	26.10 (15.80-49.60)	<0.001
BMI Group n (%)			
Underweight	2 (0.5)	6 (1.9)	<0.001
Normal weight	75 (17.0)	123 (38.6)	
Overweight	175 (39.8)	108 (33.9)	
Obesity class I	127 (28.9)	56 (17.6)	
Obesity class II	47 (10.7)	17 (5.3)	
Obesity class III	14 (3.2)	9 (2.8)	
NC (cm)	39.0 (16.0-56.0)	37.50 (19.0-59.0)	<0.001
MUAC (cm)	31.0 (21.0-46.0)	28.0 (16.0-48.)	<0.001
Total protein (g/dL)	6.70 (2.0-2.0-8.93)	6.51 (1.66-8.45)	0.002
Albumin (g/dL)	4.01 (0.90-7.94)	3.81 (2.0-7.0)	<0.001

BMI: body mass index, MUAC: mid-upper arm circumference, NC: neck circumference, SD: standard deviation

insufficient number of healthcare personnel is another obstacle to the measurement of anthropometric parameters.[37] In addition, in a study in which MUST including BMI assessment was used in 3 hospitals in the United Kingdom, it was reported that one-third of the healthcare personnel could not perform the screening correctly, although the personnel were trained on MUST.[38] In our study, the correlation between BMI values and 3-MinS and NRS-2002 scores was examined, and a weak negative correlation with NRS-2002 and a moderate negative correlation with 3-MinNS was found. There was a strong positive correlation between the scores of 3-MinNS and NRS-2002. In addition, the fact that 3-MinNS has a statistically significant negative correlation with prognostic markers such as total protein and albumin, which are used to determine nutritional

Table 2 - Correlation of participants' 3-MinNS and NRS-2002 scores with some parameters.

Variables	3-MinNS		NRS-2002	
	r	*P*-value	r	*P*-value
3-MinNS	-	-	0.719	<0.001
NRS-2002	0.719	<0.001	-	-
Age	0.245	<0.001	0.255	<0.001
BMI	-0.311	<0.001	-0.220	<0.001
NC	-0.246	<0.001	-0.172	<0.001
MUAC	-0.410	<0.001	-0.273	<0.001
Total protein	-0.157	<0.001	-0.116	<0.001
Albumin	-0.195	<0.001	-0.137	<0.001

BMI: body mass index, MUAC: Mid-upper arm circumference, NC: Neck Circumference, NRS-2002: Nutrition Risk Screening-2002, 3-MinNS: Three-Minute Nutrition Screening

Table 3 - Comparison of diagnostic parameter for 3-MinNS against NRS-2002.

Measure	Value	Lower limit	Upper limit
Sensitivity	0.791	0.735	0.838
Specificity	0.750	0.711	0.785
PPV	0.593	0.538	0.645
NPV	0.886	0.853	0.913
Positive likelihood ratio	3.163	2.689	3.721
Negative likelihood ratio	0.279	0.217	0.359

NPV: negative predictive value, NRS-2002: Nutrition Risk Screening-2002, PPV: positive predictive value, 3-MinNS: Three-Minute Nutrition Screening

status,and with anthropometric measurements such as BMI, NC, and especially MUAC, which are more independent of edema-induced weight fluctuations (Table 2) suggests that this NST can be used to determine nutritional deficiency in patients with CVD.[36,39] Based on these, it can be concluded that a simpler and faster NST such as 3-MinNS is effective in determining nutritional risk without the need for a parameter that requires measurement, such as BMI.

The selection, reporting, and interpretation of parameters used in NSTs, including cut-off values, may differ between different racial groups, cultural contexts, patient groups and health systems. Therefore, NSTs need to be validated in the specific setting, population, and disease group in which they will be used. It should also be emphasized that the validity and reliability of NSTs should be tested among specific target populations. 3-MinNS was found to be an NST with high sensitivity, specificity, PPV, and NPV that detects patients at risk of malnutrition during hospitalization. In addition, one of the most important aspects of the study in which 3-MinNS was developed and validated is that it has a large sample and represents the profile of the hospital in terms of gender and racial diversity. The strengths of our study include the fact that the sample size and gender distribution were similar to the original

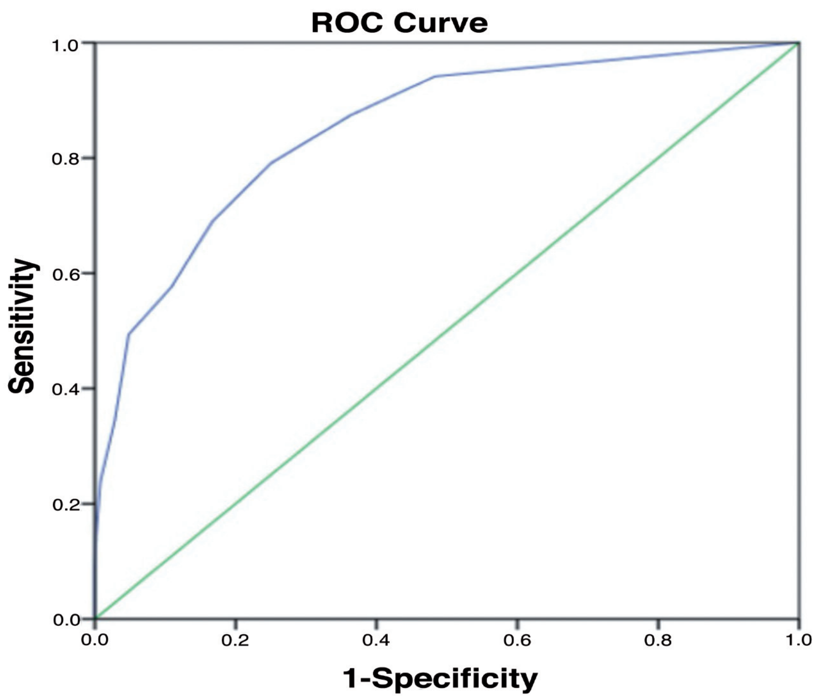

Figure 1 - Performance of 3-MinNS in predicting nutritional risk.

3-MinNS study.[22] In a study carried out in Malaysia with 3-MinNS, sensitivity was 61.4–68.5%, meaning that there was a 31.5–38.6% probability that patients were not correctly identified as at risk of malnutrition.[25] In other studies, the sensitivity was 86-89% and, specificity was 83–88% of 3-MinNS.[22,40] In our study, sensitivity was 79.1% and, specificity was 75%, which is, which is between the values of the other three studies using 3-MinNS (**Table 3**). This value suggests that NRS-2002 was used as the reference standard in determining the efficacy of 3-MinNS.

For NSTs, a high NPV is appropriate. This is due to the fact that the primary goal of NST is to assess the risk of malnutrition and provide appropriate interventions. With an NPV of 94%, 3-MinNS is a desirable NST that can lower the number of individuals who are overlooked but are at danger of malnutrition. Furthermore, when it comes to identifying the danger of malnutrition in patients who have just been admitted to the hospital, it has high specificity and acceptable sensitivity.[22] In our study, the NPV value was found to be 88.6% in parallel with the opinions on NPV. This gives a clue that 3-MinNS can predict nutritional risk in patients with CVD. This suggests that the health personnel who will apply 3-MinNS in the next stage will give accurate results in determining the risk of malnutrition in this patient group. In addition, the success of 3-MinNS in detecting malnutrition in patients with CVD was examined according to the cut-off values recommended by the MaNuEL Consortium, and it was determined that 3-MinNS is a moderately effective NST that can be used in patients with CVD.[33]

Study strengths and limitations. Although our study has several advantages, it also has some limitations. First, this study is cross-sectional in design, which limits the ability to assess the longitudinal performance of the 3-MinNS tool in predicting clinical outcomes. Furthermore, patients from a single center were included in the study for a limited period. An essential aspect of preventing malnutrition is checking nutritional status at hospitalization and monitoring nutritional status during and after hospitalization. One further constraint to be aware of is that there is a patient response bias and that a patient's response during NST may vary based on their medical state. However, the 3-MinNS tool's effect on clinical outcomes and patient care, including length of hospital stay, complications, and mortality, was not assessed in this trial. Using only two short NSTs (3-MinNS and NRS-2002) is another limitation of our study. It is conceivable that other NSTs such as the Nutritional Risk Index, Mini Nutritional Assessment, Subjective Global Assessment or MUST may perform better with 3-MinNS, but they are more challenging to implement in daily screening practices.[25] Finally, the fact that NRS-2002 was chosen as the reference standard in our study, unlike other studies, can be considered among the limitations of this study.[22,40] However, GLIM also recommends NRS-2002 as a nutritional risk NST for hospitalized patients.[20] Therefore, NRS-2002 was selected as the reference standard in our study. Prospective studies are needed to find the best and most feasible short NST to predict future outcomes in hospitalized patients.

In conclusion, detecting and treating malnutrition in patients with CVD is extremely important because factors that negatively affect the prognosis of the disease include high prevalence, impaired quality of life, increased hospitalizations, and increased mortality. However, there is still no consensus on the best method for screening nutritional status. There is a need for a quick, simple, and easy-to-use NST that requires little or no formal training to identify malnutrition. Still, 3-MinNS presents opportunities. This is because it makes it possible for medical professionals to do NST with more accuracy, ensuring that patients in need of immediate nutritional intervention receive it in a timely and effective manner. Therefore, this study examined the efficacy of 3-MinNS, a rapid, simple, and non-invasive NST, in clinically hospitalized patients with CVD. The 3-MinNS has been identified as a moderately effective NST that can be used in patients with CVD. In addition, screening patients with CVD to detect malnutrition will prevent poor prognosis and protect against CC. The study's findings validated the 3-MinNS's validity, sensitivity, and specificity when administered to hospitalized CVD patients. When a patient is admitted to the hospital, the 3-MinNS is a reliable NST that can identify them as malnourished. Since this is the first study to use the 3-MinNS with individuals who have CVD, more research is required to show that the 3-MinNS and the NRS-2002 are consistent.

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