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Validation and reliability of the modified NUTRIC score to Turkish: intensive care unit patients

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ABSTRACT

Aims: This study aimed to evaluate the psychometric properties of the Turkish version of the modified NUTRIC (mNUTRIC) score among critically ill patients in intensive care units (ICUs).

Methods: Conducted as a methodological study between June 2018 and December 2021, data were collected from 106 patients in the ICUs of two hospitals. The study utilized a patient information form, the mNUTRIC score, and the nutritional risk screening tool (NRS-2002) for assessment.

Results: The Turkish mNUTRIC score demonstrated robust validity and reliability in patients receiving mechanical ventilation within the first 24 hours of ICU admission. A significant proportion (85.85%) of patients were identified as high risk according to the mNUTRIC score. A strong positive correlation was observed between the mNUTRIC and NRS-2002 scores ($p<0.05$), confirming the validity of the mNUTRIC score. Additionally, the score exhibited high sensitivity (85.84%) in identifying patients requiring nutritional support.

Conclusion: The Turkish adaptation of the mNUTRIC score has been successfully validated and shown to be a reliable tool for assessing nutritional risk in critically ill ICU patients. Its application can support the timely identification of patients at high nutritional risk and facilitate appropriate interventions.

Keywords: Malnutrition, intensive care, mNUTRIC score, validation, reliability

INTRODUCTION

Malnutrition is a major concern for patients in intensive care units (ICUs), with prevalence rates ranging from 22% to 85%, depending on the assessment method and patient population (Amelia et al., 2023; Ouaijan et al., 2023; Tuyishime et al., 2022). This condition significantly impacts morbidity, mortality, and healthcare costs by exacerbating inflammation, increasing infection rates, and prolonging hospital stays (Eldehily et al., 2023; Hoffmann et al., 2021; Nigatu et al., 2021). Early and accurate identification of nutritional risk in ICU patients is essential to mitigate these adverse outcomes and improve patient care. The assessment of malnutrition in ICU patients is a fundamental aspect of nursing care, particularly in surgical and medical ICU settings. In surgical ICUs, adequate nutritional support is crucial for postoperative recovery, while careful nutritional planning is often required to manage chronic and acute conditions in medical ICUs. This process is crucial for maintaining the general well-being of patients, preventing complications such as infections and delayed wound healing, and accelerating their recovery processes. Therefore, nurses play a vital role in detecting the risk of malnutrition early and providing effective interventions. The mNUTRIC score, in particular, serves as a valuable tool for surgical nurses by enabling early detection of malnutrition risks and guiding timely interventions.

Providing early enteral nutrition to appropriate ICU patients has a positive effect on outcomes (Mishra et al., 2023). Providing adequate nutrition can help mitigate the consequences of the catabolic response associated with the reasons for ICU

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admission (Pardo et al., 2023). A nutritional assessment within 48 hours of a patient's admission to the ICU is crucial for identifying malnutrition risk. Nurses are responsible for regularly assessing the nutritional status of ICU patients and planning and implementing appropriate nutrition protocols with a multidisciplinary team. Although many nutritional assessment tests have been used to evaluate nutrition, there is no specific assessment method for ICU patients (Cattani et al., 2020; Smith et al., 2023; Valter et al., 2024). Many tests used to assess nutritional status include anthropometric measurements, physical examinations, history of weight loss, dietary intake, and clinical diagnoses (Kondrup et al., 2003). Poor-quality anthropometric data affect the prevalence of malnutrition and can negatively impact nutritional planning (Santana dos Santos et al., 2024). Because ICU patients are mechanically ventilated and sedated, it is difficult to obtain a history of weight loss or food intake. It is difficult to monitor weight changes in patients for reasons such as edema and fluid overload due to the underlying disease. Hemodynamic instability with muscle and fat loss also makes it difficult to assess nutritional status in ICU patients, and most of the tests used do not address parameters related to the inflammatory process and hypermetabolic state in ICU patients (Preiser et al., 2015).

The Nutrition Risk in the Critically ill (NUTRIC score) was first developed by Heyland et al. (2011) to assess nutrition in intensive care patients (Heyland et al., 2011). This score includes markers for acute and chronic fasting status, acute and chronic inflammatory status, and the Acute Physiology and Chronic Health Evaluation II (APACHE II) and Sequential Organ Failure Assessment (SOFA) scores to assess the severity of illness (Knaus et al., 1985; Moreno et al., 1999). The NUTRIC score also assesses age, number of comorbidities, length of stay in the ICU, and interleukin-6 (IL-6) levels. The use of IL-6 levels in the ICU is not common. The modified NUTRIC (mNUTRIC) score, which is used without assessing the IL-6 level, has been validated in ICU patients and is used in studies (Kalaiselvan et al., 2017; Mukhopadhyay et al., 2017; Rahman et al., 2016). Nutritional assessment becomes more challenging, especially due to a lack of communication with patients regarding mechanical ventilation treatment and treatment-related complications. Around 15-60% of ICU patients assessed with the mNUTRIC score are at high risk for nutritional deficiency, which leads to an increase in 28-day mortality (Coltman et al., 2015; Heyland et al., 2015; Kalaiselvan et al., 2017; Lin et al., 2021; Machado dos Reis et al., 2020; Mukhopadhyay et al., 2017). It has also been reported to prolong the time on mechanical ventilation, the ICU stay, and the hospital stay (Heyland et al., 2011; Kalaiselvan et al., 2017; Mukhopadhyay et al., 2017; Rahman et al., 2016; Reis et al., 2019). The American Society of Parenteral and Enteral Nutrition (ASPEN) also recommends the use of the NUTRIC score to assess nutritional risk in ICU patients (Warren et al., 2016).

This study aims to adapt and validate the Turkish version of the mNUTRIC score, in order to provide healthcare professionals with a practical tool for assessing nutritional risk in critically ill patients. By addressing this gap, the study seeks to improve the accuracy of nutritional assessments and enhance clinical outcomes in Turkish ICU settings.

METHODS

Ethical and Research Approvals

Ethical approval was obtained from the University of Health Sciences Non-interventional Researches Ethics Committee (Date: 25.02.2020, Decision No: 2019/426) and the participating hospitals. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. The relatives of the patients were informed about the aims and methods of the research before they participated in the study, and all of them participated voluntarily. Written informed consent was secured from patient relatives before participation.

Setting and Sample

This methodological study was conducted in the intensive care units of two hospitals between June 2018 and December 2021. All patients who met the inclusion criteria within the specified timeframe were included in the study, with no sample selection. A total of 106 patients were included in the study. A post-hoc power analysis was conducted using G*power software for the correlation analysis in this study. With a total sample size of 106, a significance level (α) of 0.05, and a correlation coefficient (r) of 0.78, the achieved statistical power was calculated to be 1.00. This indicates that the study had sufficient power to detect a significant correlation between mNUTRIC and NRS-2002 scores.

The inclusion criteria were as follows; i) critically ill adult patients (aged ≥18 years); and ii) patients who required invasive mechanical ventilation within 24 hours of admission to the ICU.

Patients were excluded if the time between ICU admission and discharge was less than 24 hours or if the patient's relative did not agree to the patient's participation in the study.

Data Collection

The relatives of patients who met the inclusion criteria were informed about the study within the first 24 hours after admission to the ICU, and written informed consent was obtained. Because of the study design, nutritional support was not standardized. A patient information form was used to collect the descriptive characteristics of the participants, the mNUTRIC score, and the Nutritional Screening Tool-2002 (NRS-2002).

Patient Information Form: This form, developed based on a comprehensive review of relevant literature, included sociodemographic and clinical variables such as age, gender, comorbidities, and ICU admission details (Coltman et al., 2015; Heyland et al., 2015; Kalaiselvan et al., 2017; Mukhopadhyay et al., 2017; O'Meara et al., 2008; Ukleja, 2010; Warren et al., 2016).

The mNUTRIC score: The mNUTRIC score developed by Heyland et al. (2015) is calculated for each patient on the basis of the patient's age, APACHE II score at admission, SOFA score, number of comorbidities, and time elapsed between hospital admission and admission to the unit (Heyland et al., 2015; Knauset al., 1985; Moreno et al., 1999). The score is calculated using values obtained within the first 24 hours of the patient's admission to the ICU. The developers of the scale have stated that the mNUTRIC score can be calculated without including the IL-6 level in the score if it is not clinically relevant. The

mNUTRIC score is scored between 0 and 9. A total score of 5 or above indicates a high risk of malnutrition (Heyland et al., 2015).

NRS-2002: The NRS-2002, developed by Kondrup et al. (2003) and validated in Turkish by Bolayır et al. (2018), aims to detect malnutrition and the risk of malnutrition and to identify patients who may benefit from nutritional support (Bolayır et al., 2018; Kondrup et al, 2003). The NRS-2002 asks about body-mass index (<20.5), decreased food intake in the past week, weight loss in the past 3 months, and the presence of serious illness. If there is a positive response to any of these four questions, the assessment continues. Nutritional status was assessed with a score of 0-3, severity of illness was assessed with a score of 0-3, and +1 point was added if the patient was ≥70 years of age. If the resulting score is ≥3, it is concluded that there is nutritional risk, and a nutritional plan should be initiated (Bolayır et al., 2018).

Statistical Analysis

SPSS 21.0 was used for data analysis. The number, percentage, median and interquartile range were used for descriptive statistics. Since the mNUTRIC score is not a Likert scale and does not have subdimensions, construct validity could not be assessed. Language and face validity were assessed during the adaptation process. The guidelines by Center (2016) were followed for the translation and adaptation of the mNUTRIC score. The facial validity of the mNUTRIC score was assessed by the researchers. The Mann-Whitney U test was used to compare the data of patients with low and high mNUTRIC scores. The Kolmogorov-Smirnov test was used to evaluate the normality of the data. The NRS-2002 was used to assess criterion validity. Criterion validity was assessed via the Pearson correlation test. The sensitivity of the measurement tool was evaluated to determine its effectiveness in identifying patients who require nutritional support. Since all patients included in the study had severe disease according to the NRS-2002, it was concluded that all patients should be started on nutritional support. Therefore, the specificity of the new tool could not be evaluated. The data are reported with 95% confidence intervals.

RESULTS

The validity and reliability of the mNUTRIC score for the Turkish population were tested in patients over 18 years of age who received mechanical ventilation within the first 24 hours in the intensive care unit. A total of 106 patients participated in the study. Among them, 85.85% were classified as high nutritional risk based on the mNUTRIC score. The characteristics of patients admitted to the ICU are expressed as low and high mNUTRIC scores (Table 1). Among those with high mNUTRIC scores, 50.5% were male, while 80% of those with low mNUTRIC scores were male. The median age of the participants was 73 (63-81) years for patients with a high mNUTRIC score and 53 (42-69) years for patients with a low mNUTRIC score. The median APACHE II and SOFA scores for patients with high mNUTRIC scores were 30 (24-37) and 11 (9-12), respectively. The median number of comorbidities was 2 (1-3), and the median time from hospital admission to ICU admission was 1 (0-24) hour. The median body-mass index was 24.6 (23-27.6) kg/m². Patients with a low mNUTRIC score were more likely to be male (p<0.05). Patients with high mNUTRIC scores were older (median age 73 vs. 53 years, p<0.05), had higher APACHE II (30 vs. 15, p<0.05) and SOFA scores (11 vs. 5, p<0.05), and more comorbidities (2 vs. 0, p<0.05) compared to those with low scores (Table 1). The relationships between the mNUTRIC score and NRS-2002 score are shown in Table 2. The mNUTRIC and NRS-2002 scores showed a positive correlation (r=0.243, p=0.012), indicating that the mNUTRIC score is a valid and reliable tool for assessing nutritional risk in Turkish ICU patients. The ability of the NRS-2002 and mNUTRIC scores to identify patients requiring nutritional support is shown in Table 3. The mNUTRIC score demonstrated high sensitivity (85.84%) in identifying patients at nutritional risk. These findings support the mNUTRIC score as a valid and reliable tool for assessing nutritional risk in Turkish ICU patients.

Table 1. Characteristics of the patients admitted in the ICU (n=106)

		Low NUTRIC score	High NUTRIC score	
		15 (14.15)	91 (85.85)	
		n (%)	n (%)	p-value
Gender	Male	12 (80)	46 (50.5)	0.030*
	Female	3 (20)	45 (49.5)	
		Median (IQR)	Median (IQR)	
Age, in years		53 (42-69)	73 (63-81)	<0.001**
APACHE II		18 (16-26)	30 (24-37)	<0.001**
SOFA		9 (8-9)	11 (9-12)	0.005**
Number of comorbidities		1 (0-3)	2 (1-3)	0.029**
Days from hospital admission to ICU		1 (1-3)	1 (0-24)	0.372**
BMI (kg/m²)		26.4 (22-28)	24.6 (23-27.6)	0.562**

Values described as mean±standard deviation, median (interquartile range) or n (%). *Fisher's exact test applied depending on the cell frequencies, **Mann-Whitney U test, ICU: Intensive care unit, NUTRIC: Nutrition risk in the critically, IQR: Inter quantile range, APACHE II: Acute physiology and chronic health evaluation II, SOFA: Sequential organ failure assessment, BMI: Body-mass index

Table 2. Relationship between mNUTRIC score and NRS 2002 results

	Mean±SD	p	r*
mNUTRIC score averages	6.16±1.53	0.012	0.243
NRS 2002 score averages	5.08±0.95		

*Pearson correlation test, mNUTRIC: Modified nutrition risk in the critically, NRS: Nutritional risk screening tool, SD: Standard deviation

Table 3. Comparison of mNUTRIC score and NRS 2002 results

		Results of NRS-2002		
		Needs nutritional support	No need for nutritional support	Total
mNUTRIC score results	High mNUTRIC score	91	0	91
	Low mNUTRIC score	15	0	15
	Toplam	106	0	106

mNUTRIC: Modified nutrition risk in the critically

DISCUSSION

The NUTRIC score, designed specifically to evaluate nutritional risk in critically ill patients, highlights the necessity of creating tailored tools for individuals with distinct clinical needs (Rosa et al., 2016). The validity and reliability of the mNUTRIC score were assessed within the scope of our study. Measuring variability over time is one method used to

evaluate the reliability of a measurement tool. However, since the instrument was administered within the first 24 hours of the patients' admission to the ICU and the APACHE 2 and SOFA scores, which are among the information needed for the assessment, were assessed with the results within 24 hours, no assessment could be made with a retest.

In our study, the criterion validity of the measurement tool was assessed by comparing it with the NRS 2002 score. Correlation coefficients are used to evaluate the strength and direction of linear relationships between pairs of continuous variables (Gogtay & Thatte, 2017). According to the correlation results between the two measurements, there was a significant correlation, indicating that the use of the tool is valid in the Turkish population. Researchers should prioritize careful evaluation and interpretation of the sensitivity and specificity of screening tests (Trevethan, 2017). When the results of these two measurements are compared to determine the nutritional support needs of patients, the mNUTRIC score has high sensitivity, with a sensitivity of 85.84%. According to de Vries et al. (2018), the mNUTRIC score has a sensitivity of 88.4% (de Vries et al., 2018). Although a test with 100% sensitivity is ideal for detecting disease, it does not imply that the test is flawless (Wang et al., 2021). Nevertheless, achieving near-perfect specificity is considered an acceptable outcome.

Our study revealed that 85.85% of patients were at high risk of malnutrition. In studies assessing the risk of malnutrition via the mNUTRIC score, 46%, 48.6%, 31.67%, 42.5%, 43.41%, and 48.4% of patients were in the high-risk group (Kalaiselvan et al., 2017; Lin et al., 2021; Machado dos Reis et al., 2020; Mendes et al., 2017; Rattanachaiwong et al., 2020; Rosa et al., 2016). The higher rate of patients at high risk for malnutrition in our study may be due to the fact that the patients included were critically ill and required intubation within the first 24 hours. In other studies, the sample included all patients, including those not at high risk of malnutrition.

In our study, patients with high mNUTRIC scores were older, had higher APACHE II and SOFA scores, and had more comorbidities. Patients with high mNUTRIC scores were older in the other studies (Kalaiselvan et al., 2017; Rosa et al., 2016). Patients with higher mNUTRIC scores had higher APACHE II and SOFA scores in other studies (Kalaiselvan et al., 2017; Mahmoodpoor et al., 2023; Rosa et al., 2016). In the study by Rosa et al. (2016), patients with high mNUTRIC scores had more comorbidities, which is consistent with the findings of our study, where higher mNUTRIC scores were also associated with an increased number of comorbidities (Rosa et al., 2016). These results highlight the importance of integrating the mNUTRIC score into routine ICU protocols to enable early identification and intervention for patients at nutritional risk. The NUTRIC score is a fast, practical instrument for routine ICU care. It has the clear advantage of applying to patients unable to respond verbally, such as those on mechanical ventilation, as its variables are objectively obtained from routinely recorded medical data (Rosa et al., 2016). By emphasizing the importance of nutritional support and identifying those at high risk for malnutrition, daily use of this tool with critically ill patients appears to be beneficial (Mendes et al., 2017).

Implications to Clinical Practice

Integrating the mNUTRIC score into routine ICU workflows can enhance care by identifying malnutrition risks early and enabling timely interventions. Nurses play a crucial role by performing nutritional assessments within the first 24 hours of ICU admission, supported by structured protocols. Incorporating the mNUTRIC score into electronic medical records can automate calculations, making risk monitoring seamless. Multidisciplinary meetings involving nurses, dietitians, and physicians can focus on high-risk cases, ensuring collaborative care. Adopting the mNUTRIC score as a standard tool can improve patient outcomes through proactive and coordinated nutritional management.

Limitations

On the other hand, in our study, according to the results of the NRS 2002, all patients who met the inclusion criteria were interpreted as having nutritional needs. Therefore, the specificity of the tool could not be evaluated. However, the mNUTRIC score is considered more appropriate for use in ICUs, as it reflects whether nutritional support is provided on the basis of the reasons for ICU admission and the combined assessment of APACHE II and SOFA scores, which are commonly used in ICUs.

CONCLUSION

The translation of the mNUTRIC score into Turkish was successful, providing a practical and reliable tool for identifying critically ill patients in need of nutritional support in ICU settings. This study underscores the value of the mNUTRIC score in addressing malnutrition risk among Turkish ICU patients. Its adoption can be particularly impactful in both surgical and medical ICUs by enhancing care protocols and improving recovery outcomes through timely nutritional interventions. By incorporating the mNUTRIC score into routine practice, healthcare providers can better address the complex nutritional needs of critically ill patients in diverse ICU settings. Future research could examine the predictive value of the mNUTRIC score in relation to long-term patient outcomes such as mortality, recovery times and quality of life. Furthermore, studies focusing on diverse ICU populations, including paediatric and specialised surgical ICUs, could provide further insights into the tool's applicability and robustness in different clinical settings. Investigating the integration of the mNUTRIC score into automated healthcare systems could enhance its practical use and accessibility in real-world settings.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was initially approved by the University of Health Sciences Non-interventional Researches Ethics Committee (Date: 26.06.2018, Decision No: 2018/9). However, due to the expansion of the data collection area and the addition of new researchers, an updated ethics approval was obtained from the same committee (Date: 25.02.2020, Decision No: 2019/426).

Informed Consent

Written informed consent was secured from patient relatives before participation.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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