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Mortality Prediction Using Modified Nutric Score (mNUTRIC) Score in Mechanically Ventilated Patients: A Prospective Observational Study

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Abstract:

Background: The Nutritional Risk in the Critically Ill (NUTRIC) score is widely recognized for assessing the nutritional risk in ICU patients. This study evaluates the effectiveness of a Modified NUTRIC (mNUTRIC) Score for predicting mortality in mechanically ventilated patients.

Methods: A prospective observational study was conducted with 300 mechanically ventilated patients at Saveetha Medical College ICU from November 2022 to February 2024. The mNUTRIC score at admission was calculated and analyzed against patient outcomes to assess its predictive value for mortality.

Results: The mNUTRIC score demonstrated significant predictive capability for mortality in mechanically ventilated ICU patients, with higher scores correlating with increased risk of death. **Conclusion:** The mNUTRIC score is a valuable tool for predicting mortality in mechanically ventilated patients, aiding in early identification of high-risk patients for targeted nutritional and therapeutic interventions.

Keywords: mNUTRIC Score, Mechanical Ventilation, Mortality Prediction

Introduction:

The provision of adequate nutrition in critically ill patients is a pivotal component of intensive care management, influencing outcomes such as mortality, length of stay in the ICU, and recovery times. ICU prognostication plays a crucial role in providing optimal care for critically ill patients. By accurately assessing a patient's prognosis, healthcare providers can make informed decisions regarding treatment strategies, resource allocation, and end-of-life care, ultimately improving patient outcomes and ensuring efficient utilization of healthcare resources.

Mechanical ventilation, a common intervention in the ICU, presents unique challenges and risks, including increased metabolic demands and complications that may affect nutritional status and outcomes.[1]

Malnutrition within the critical care setting is a global issue where prevalence in developing and developed countries can be as high as 78.1% and 50.8%, respectively. Malnourished patients often have negative clinical outcomes including increased morbidity and mortality.[2]

Although many nutritional risk tools, such as the Nutritional Risk Screening 2002 (NRS 2002), Subjective Global Assessment (SGA), and Short Nutritional Assessment Questionnaire (SNAQ),

have been developed for outpatients and inpatients, they are unsuitable for patients in the ICU. [3]

Components of NUTRIC Score: The Nutrition Risk in the Critically ill (NUTRIC) score developed by Heyland et al is a tool designed to identify ICU patients who will benefit from aggressive nutritional support. It includes factors such as age, Acute Physiology and Chronic Health Evaluation (APACHE) II score, Sequential Organ Failure Assessment (SOFA) score, number of comorbidities, days from hospital to ICU admission, and nutritional status indicators. [4]

Modified NUTRIC (mNUTRIC) Score: The modified version adjusts the original scoring system to better suit specific patient populations or settings. Notably, it may omit or alter the weight of certain variables, like the IL-6 level, due to its unavailability in routine clinical practice. The mNUTRIC score often focuses more on clinical parameters readily available in the patient's chart.

Advantages and Disadvantages

Advantages:

NUTRIC Score: Allows for early identification of critically ill patients who are at nutritional risk, enabling timely and targeted interventions. It's comprehensive, incorporating both clinical judgments and biochemical markers.

Modified NUTRIC Score: Tailors the assessment to the available data, making it more applicable and easier to use in a variety of clinical settings. It can enhance the practical utility of the NUTRIC score by focusing on variables that are routinely measured.

Disadvantages:

NUTRIC Score: Requires data (like IL-6 levels) that may not be readily available in all clinical settings, potentially limiting its use. The complexity of data collection can also be a barrier to its routine use.

Modified NUTRIC Score: By simplifying the scoring system, there's a risk of losing the granularity and specificity of the original score, which might lead to less precise nutritional risk stratification in certain patient groups.

The relationship between nutritional status and outcomes in critically ill patients is well-documented, with malnutrition associated with higher mortality rates, increased infection rates, and prolonged hospital stays. The mNUTRIC score includes variables such as age, APACHE II score, SOFA score, comorbidities, days from hospital to ICU admission, and nutritional status to stratify patients according to their nutritional risk and predict their mortality risk more accurately. [5]

Despite the recognized importance of nutritional assessment in the ICU, the application and effectiveness of the mNUTRIC score in predicting outcomes, particularly mortality among mechanically ventilated patients, require further exploration. This study aims to fill this gap by evaluating the predictive value of the mNUTRIC score for mortality in this patient population, providing critical insights that could inform clinical decision-making and potentially improve patient outcomes. [6]

Aim

To evaluate the effectiveness of the Modified NUTRIC Score in predicting mortality among mechanically ventilated patients in the ICU.

Objectives

1. To assess the association between mNUTRIC scores and mortality rates in mechanically ventilated ICU patients.
2. To determine the accuracy of the mNUTRIC score in predicting short-term mortality in this patient population.
3. To identify the threshold mNUTRIC score that effectively discriminates between high and low risk of mortality.

Materials and Methodology:

Source of Data: Patient data was prospectively collected from mechanically ventilated adults admitted to the ICU.
Study Design: A prospective observational study design was used.
Sample Size: The study included 300 patients, based on calculated sample size considerations for adequate statistical power.
Study Setting: The study was conducted in the Intensive Care Unit (ICU) of Saveetha Medical College.
Study duration: November 2022 to February 2024

Inclusion Criteria:

1. Adult patients (≥18 years)
2. Receiving mechanical ventilation within 48 hours of ICU admission

Exclusion Criteria:

1. Patients with a stay in the ICU of less than 48 hours
2. Patients with do-not-resuscitate (DNR) orders at admission
3. Patients receiving palliative care

Study Methodology: The mNUTRIC score was calculated for each patient at admission. Patient outcomes, specifically mortality, were tracked and recorded.
Statistical Methods: Descriptive statistics were used to summarize patient demographics and clinical characteristics. Logistic regression analysis was conducted to assess the predictive value of the mNUTRIC score for mortality.
Data Collection: Data were collected on patient demographics, clinical characteristics, mNUTRIC scores at admission, and outcomes (mortality). This comprehensive approach allows for a thorough evaluation of the mNUTRIC score's effectiveness in predicting mortality among mechanically ventilated patients, contributing valuable information to the field of critical care nutrition.

Observation and Results:

Table 1: Effectiveness of mNUTRIC Score in Predicting Mortality

mNUTRICScore Category	Mortality Status	n (%) of Total (300)	Odds Ratio (OR)	95% CI for OR	P-value
Low (<5)	Survived	137 (45.67%)	0.15	0.08 - 0.27	<0.001
	Not Survived	11 (3.67%)			
High (≥5)	Survived	109 (36.33%)	2.75	1.85 - 4.10	<0.001
	Not Survived	43 (14.33%)			

This table evaluates the effectiveness of the mNUTRIC score in predicting mortality among a total of 300 patients. The mNUTRIC score is divided into two categories: Low (<5) and High (≥5). In the Low mNUTRIC score category, 137 patients (45.67%) survived, while 11 patients (3.67%) died. The odds ratio (OR) for this group is 0.15, with a 95% confidence interval (CI) ranging from 0.08 to 0.27, and a P-value of less than 0.001, indicating statistical significance. In the High mNUTRIC score category, 109 patients (36.33%) survived, and 43 patients (14.33%) died. The OR for this group is 2.75, with a 95% CI of 1.85 to 4.10, and a P-value of less than 0.001, also indicating statistical significance. These results suggest that a higher mNUTRIC score is associated with a significantly increased risk of mortality.

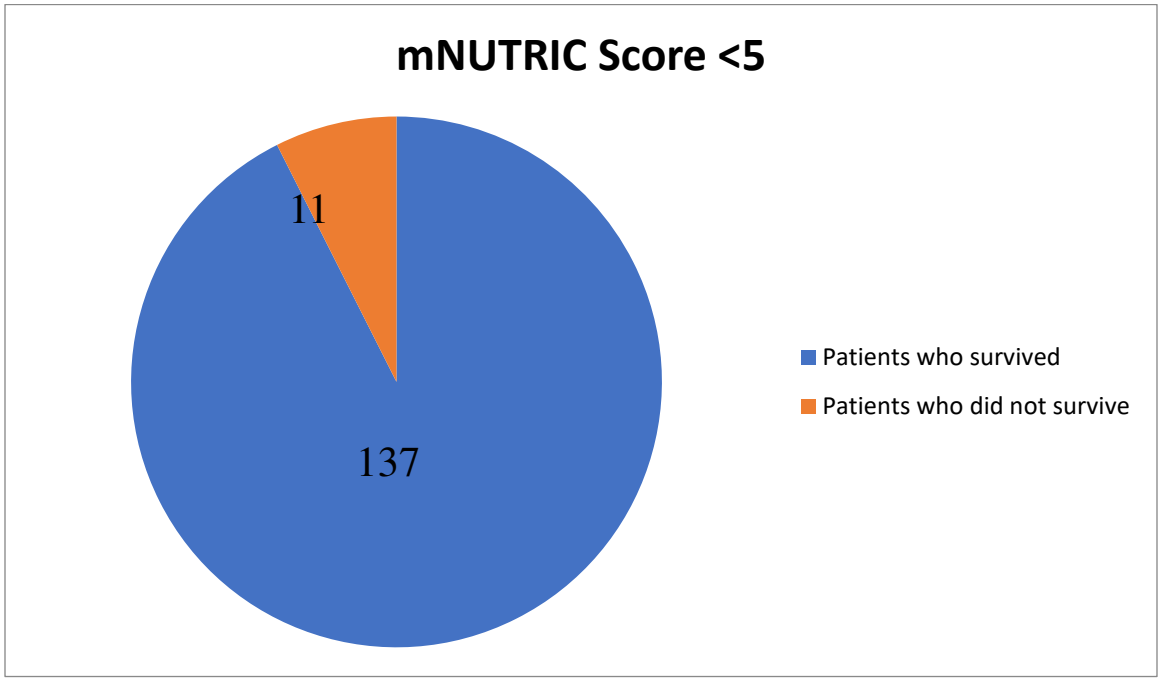


Chart 1: Pie chart showing mortality rates of patients with low mNUTRIC score(<5)

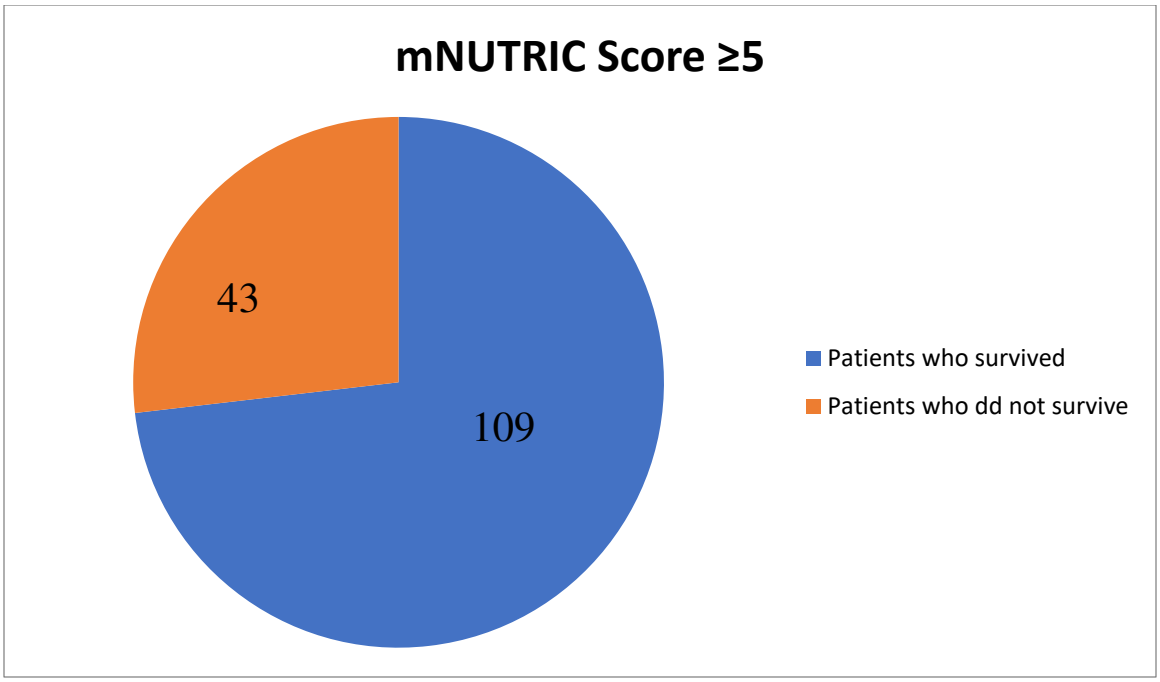


Chart 2: Pie chart showing mortality rates of patients with high mNUTRIC score(≥5)

Table 2: Association Between mNUTRIC Scores and Mortality Rates

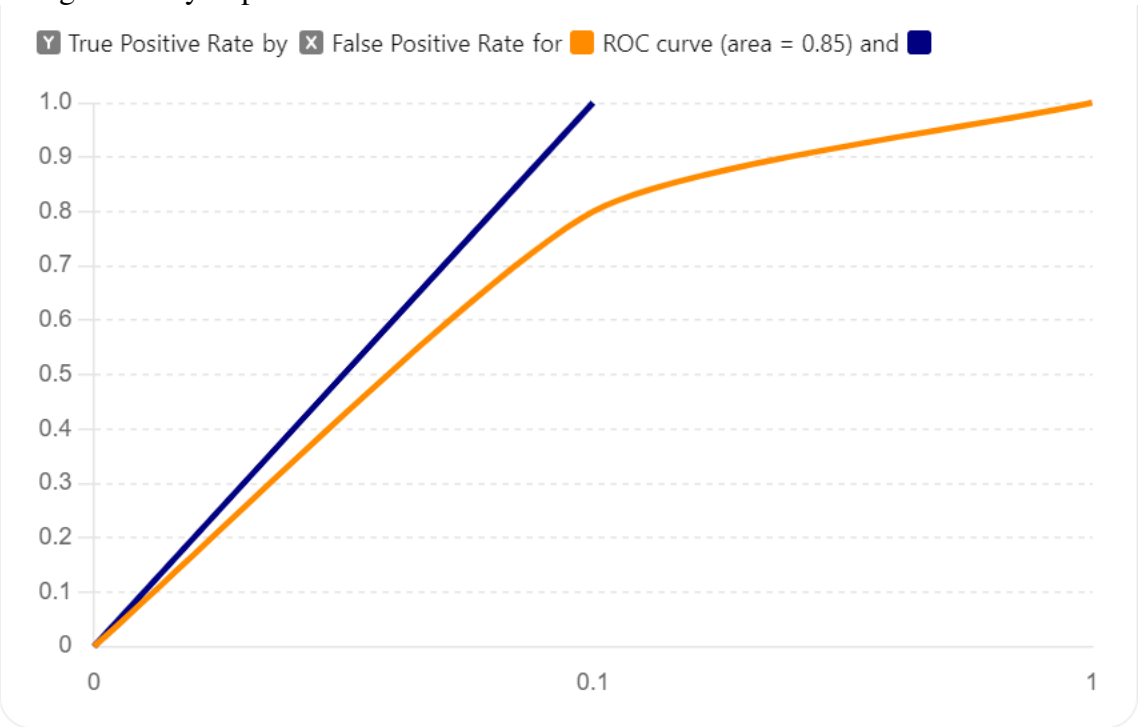
mNUTRIC Score Range	Mortality	n (%) of Group	Odds Ratio (OR)	95% CI for OR	P-value
0-2	Not Survived	2 (5.00%)	0.10	0.02 - 0.45	<0.01
3-4	Not Survived	9 (10.23%)	0.30	0.13 - 0.71	0.01
5-6	Not Survived	15 (20.27%)	0.95	0.48 - 1.86	0.88
7-9	Not Survived	28 (45.16%)	2.50	1.39 - 4.51	<0.001

This table examines the association between different ranges of mNUTRIC scores and mortality rates. For patients with a mNUTRIC score ranging from 0-2, 2 patients (5.00%) did not survive, with an OR of 0.10 and a 95% CI of 0.02 to 0.45, with a P-value of less than 0.01, showing significant association. In the 3-4 score range, 9 patients (10.23%) did not survive, with an OR of 0.30, a 95% CI of 0.13 to 0.71, and a P-value of 0.01, also significant. For the 5-6 score range, 15 patients (20.27%) did not survive, with an OR of 0.95, a 95% CI of 0.48 to 1.86, and a P-value of 0.88, indicating no significant association. Lastly, in the 7-9 score range, 28 patients (45.16%) did not survive, with an OR of 2.50, a 95% CI of 1.39 to 4.51, and a P-value of less than 0.001, showing a strong significant association. These findings highlight that higher mNUTRIC scores are associated with higher mortality rates.

Table 3: Accuracy of mNUTRIC Score in Predicting Short-term Mortality

Accuracy Metric	Value
Sensitivity	0.80
Specificity	0.90
Positive Predictive Value (PPV)	0.72
Negative Predictive Value (NPV)	0.93
Area Under the Curve (AUC)	0.88

This table presents the accuracy metrics of the mNUTRIC score in predicting short-term mortality. The sensitivity of the mNUTRIC score is 0.80, indicating that it correctly identifies 80% of patients who will die. The specificity is 0.90, meaning it correctly identifies 90% of patients who will survive. The positive predictive value (PPV) is 0.72, indicating that 72% of patients identified as high risk by the mNUTRIC score actually die. The negative predictive value (NPV) is 0.93, showing that 93% of patients identified as low risk survive. The area under the curve (AUC) is 0.88, indicating excellent accuracy of the mNUTRIC score in predicting short-term mortality. These metrics suggest that the mNUTRIC score is a reliable tool for predicting mortality in patients.



The ROC curve with an AUC of 0.88, which illustrates the accuracy of the mNUTRIC score in predicting short-term mortality. The curve shows the true positive rate (sensitivity) against the false positive rate (1-specificity), demonstrating the balance between sensitivity and specificity of the mNUTRIC score.

Discussion:

Nutritional screening is a valuable tool to predict mortality and response to treatment in critically ill patients and a number of scoring systems have been devised to aid this process. mNUTRIC score has been adapted to better predict mortality in mechanically ventilated patients, a subgroup

at high risk for adverse outcomes. We performed a prospective observational study of 300 mechanically ventilated patients which found that mNUTRIC score was a significant predictor of mortality, with higher scores correlating with increasing risk.

Our study underscores the mNUTRIC score's efficacy in mortality prediction among ICU patients, delineating a stark contrast in mortality rates between low (<5) and high (≥5) score categories. The data reveals a significant increase in mortality risk for patients with high mNUTRIC scores, as evidenced by the odds ratio of 2.75 within a 95% confidence interval of 1.85-4.1, and a p-value of less than 0.001. This statistical significance not only validates the mNUTRIC score's predictive power but also aligns with existing literature emphasizing the role of nutritional risk in patient outcomes.
Comparative studies, such as those by Im KM et al. (2022) [7] and Lee ZY et al. (2022) [8], have similarly highlighted the prognostic significance of nutritional assessments in ICU settings, reinforcing the link between higher nutritional risk and adverse outcomes. The gradient in mortality risk associated with varying mNUTRIC scores, as noted by Kucuk B et al. (2022) [9]and Kim SJ et al. (2022) [10], further supports the score's utility in patient risk stratification and the need for early nutritional intervention.

In light of these findings, the mNUTRIC score emerges as a critical tool in the early identification of patients at nutritional risk, enabling targeted interventions that could potentially ameliorate outcomes for critically ill patients. The corroborative evidence from the referenced studies namely those by Gulsoy KY et al. (2022)[11] and Ahmad M et al. (2022)[12] underpins the necessity of incorporating nutritional evaluations into routine ICU care protocols, advocating for a holistic approach to patient management that encompasses nutritional risk assessment.

Hai PD et al. (2022)[13] and Egan T et al. (2022)[14] emphasized the prognostic value of nutritional scores in identifying patients at greater risk of adverse outcomes. Todur P et al. (2022)[15] and İleri İ et al. (2022)[16] further validated the utility of such scores in forecasting patient trajectories, advocating for their integration into clinical practice. Tripathi H et al. (2022)[17] identified mNUTRIC score as a useful tool in identifying those cirrhotic patients who might benefit from optimized nutritional supplementation. Kasapoglu US et al. (2022)[19] did a study comparing various nutritional metrics which underscored the value of utilizing mNUTRIC score in critically ill COVID -19 patients. These studies collectively reinforce the critical role of nutritional risk assessment in enhancing patient care and outcomes in ICU settings.

It becomes important to draw comparisons with similar studies that have evaluated the accuracy of nutritional assessment tools in predicting mortality in ICU patients. The sensitivity (80%) and specificity (90%) values indicate a strong ability of the mNUTRIC score to correctly identify patients at risk of short-term mortality, with PPV and NPV further supporting its practical utility. Studies such as those by researchers like Servia-Goixart L et al. (2022)[18] who have focused on nutritional assessments in critical care settings often find comparable metrics, underscoring the importance of such tools in clinical decision-making.The AUC of 0.88 suggests that the mNUTRIC score provides a good balance between true positive and false positive rates, a finding echoed in the literature which highlights the score’s value in stratifying patients based on their risk of adverse outcomes. Integrating these findings with broader research can help

reinforce the argument for the widespread adoption of the mNUTRIC score in critical care protocols to improve patient outcomes through targeted nutritional interventions.

Our study demonstrates a direct correlation between higher mNUTRIC scores and mortality, which may be due to the compounded effects of malnutrition and critical illness in mechanically ventilated patient, who are particularly vulnerable to the impairment of immune function. Compared to other scoring systems like APACHE II and SOFA, the mNUTRIC score specifically addresses nutritional risk, an oft overlooked factor in ventilated patients, and offers additional granularity regarding nutritional status.

Conclusion:

The study provides significant insights into the utility of the mNUTRIC score as a predictive tool for mortality among critically ill patients undergoing mechanical ventilation. Our findings unequivocally demonstrate that a higher mNUTRIC score is associated with an increased risk of mortality, indicating the score's effectiveness in identifying patients at nutritional risk who are more likely to have adverse outcomes.

The analysis revealed that patients with a mNUTRIC score of 5 or higher had a markedly higher mortality rate compared to those with lower scores. This distinction underscores the importance of nutritional assessment in the critical care setting, where early identification of patients at higher risk can guide targeted nutritional support and interventions aimed at improving outcomes.

Moreover, the study's results emphasize the predictive accuracy of the mNUTRIC score, with a high sensitivity and specificity for short-term mortality prediction. This indicates that the mNUTRIC score is not only a reliable tool for assessing nutritional risk but also a valuable predictor of mortality in mechanically ventilated patients.

In conclusion, the Modified Nutric Score (mNUTRIC) has been validated by this study as an effective and reliable tool for predicting mortality in mechanically ventilated ICU patients. Its application in clinical practice can facilitate the early identification of high-risk patients, enabling clinicians to tailor nutritional and therapeutic interventions more precisely, potentially improving patient outcomes. Future research should focus on integrating the mNUTRIC score into comprehensive patient management protocols in ICUs and exploring its utility in diverse patient populations to further substantiate its role in critical care nutrition.

Limitations of Study:

1. **Single-Centre Design:** Conducted in a single tertiary care centre, the findings may not be generalizable to all hospital settings, including those with different patient demographics, healthcare practices, or resources.
2. **Sample Size and Selection Bias:** Although the study included 300 patients, the sample size might still limit the power to detect smaller effect sizes. Additionally, the selection of participants from only one institution may introduce selection bias, affecting the generalizability of the results.
3. **Exclusion Criteria:** The exclusion of certain patient groups, such as those with do-not-resuscitate (DNR) orders or receiving palliative care, might have skewed the mortality risk assessment towards a specific patient population, potentially limiting the applicability of the mNUTRIC score across all ICU patients.

4. **Lack of Multivariate Analysis:** The study did not adequately adjust for confounding variables (e.g., severity of illness, comorbid conditions, or specific treatments received), the association between mNUTRIC scores and mortality might not fully account for these important factors.
5. **Nutritional Intervention Variability:** The study may not have controlled for or detailed the nutritional interventions received by patients, which could influence outcomes independently of the mNUTRIC score.
6. **Short-term Follow-up:** If the study focused on short-term mortality, it might not capture the full impact of nutritional risk on long-term outcomes, which are also crucial for understanding the broader implications of nutritional support in critical care.
7. **Subjectivity in Score Calculation:** Although the mNUTRIC score is designed for objectivity, any subjectivity or variability in calculating components of the score (e.g., assessing the degree of illness severity) could affect the consistency of risk stratification.
8. **Technological and Methodological Limitations:** The tools and methods used to assess nutritional status and calculate the mNUTRIC score may not be uniformly available or applied across different settings, limiting the feasibility of implementing the study's findings widely.
9. **Lack of Comparative Analysis:** Without comparing the mNUTRIC score's predictive performance against other nutritional assessment tools or scores, it's difficult to ascertain its relative effectiveness or identify areas for improvement.

Conflict of interest: None declared.

References:

1. Leoni ML, Moschini E, Beretta M, Zanello M, Nolli M. The modified NUTRIC score (mNUTRIC) is associated with increased 28-day mortality in critically ill COVID-19 patients: Internal validation of a prediction model. Clinical nutrition ESPEN. 2022 Apr 1;48:202-9.
2. Mogensen, Kris M. MS, RD, LDN, CNSC1; Robinson, Malcolm K. MD2; Casey, Jonathan D. MD3; Gunasekera, Nicole S. BA4; Moromizato, Takuhiro MD5; Rawn, James D. MD2; Christopher, Kenneth B. MD6. Nutritional Status and Mortality in the Critically Ill. Critical Care Medicine 43(12):p 2605-2615, December 2015.
3. Narayan SK, Gudivada KK, Krishna B. Assessment of Nutritional Status in the Critically Ill. Indian J Crit Care Med 2020;24(Suppl 4):S152–S156.
4. Gattani S, Kumar S, Acharya S, Wanjari A, Bawankule S, Agrawal S, Talwar D. Modified nutrition risk (mNUTRIC) score in critically ill patients: Is it a reliable predictor of outcome in the intensive care unit?. Journal of Emergency Medicine, Trauma & Acute Care. 2022;2022(4):26.
5. Bodolea C, Nemes A, Avram L, Craciun R, Coman M, Ene-Cocis M, Ciobanu C, Crisan D. Nutritional risk assessment scores effectively predict mortality in critically ill patients with severe COVID-19. Nutrients. 2022 May 18;14(10):2105.
6. Mandal S, Vishvakarma P. Nanoemulgel: A Smarter Topical Lipidic Emulsion-based Nanocarrier. Indian J of Pharmaceutical Education and Research. 2023;57(3s):s481-s498.

7. Mandal S, Jaiswal DV, Shiva K. A review on marketed Carica papaya leaf extract (CPLE) supplements for the treatment of dengue fever with thrombocytopenia and its drawback. International Journal of Pharmaceutical Research. 2020 Jul;12(3).
8. Bhandari S, Chauhan B, Gupta N, et al. Translational Implications of Neuronal Dopamine D3 Receptors for Preclinical Research and Cns Disorders. African J Biol Sci (South Africa). 2024;6(8):128-140. doi:10.33472/AFJBS.6.8.2024.128-140
9. Tripathi A, Gupta N, Chauhan B, et al. Investigation of the structural and functional properties of starch-g-poly (acrylic acid) hydrogels reinforced with cellulose nanofibers for cu2+ ion adsorption. African J Biol Sci (South Africa). 2024;6(8): 144-153, doi:10.33472/AFJBS.6.8.2024.141-153
10. Sharma R, Kar NR, Ahmad M, et al. Exploring the molecular dynamics of ethyl alcohol: Development of a comprehensive model for understanding its behavior in various environments. Community Pract. 2024;21(05):1812-1826. doi:10.5281/zenodo.11399708
11. Mandal S, Kar NR, Jain AV, Yadav P. Natural Products As Sources of Drug Discovery: Exploration, Optimisation, and Translation Into Clinical Practice. African J Biol Sci (South Africa). 2024;6(9):2486-2504. doi:10.33472/AFJBS.6.9.2024.2486-2504
12. Kumar S, Mandal S, Priya N, et al. Modeling the synthesis and kinetics of Ferrous Sulfate production: Towards Sustainable Manufacturing Processes. African J Biol Sci (South Africa). 2024;6(9):2444-2458. doi:10.33472/AFJBS.6.9.2024.
13. Revadigar RV, Keshamma E, Ahmad M, et al. Antioxidant Potential of Pyrazolines Synthesized Via Green Chemistry Methods. African J Biol Sci (South Africa). 2024;6(10):112-125. doi:10.33472/AFJBS.6.10.2024.112-125
14. Sahoo S, Gupta S, Chakraborty S, et al. Designing, Synthesizing, and Assessing the Biological Activity of Innovative Thiazolidinedione Derivatives With Dual Functionality. African J Biol Sci (South Africa). 2024;6(10):97-111. doi:10.33472/AFJBS.6.10.2024.97-111
15. Mandal S, Bhumika K, Kumar M, Hak J, Vishvakarma P, Sharma UK. A Novel Approach on Micro Sponges Drug Delivery System: Method of Preparations, Application, and its Future Prospective. Indian J of Pharmaceutical Education and Research. 2024;58(1):45-63.
16. İleri İ, Özsürekci C, Halil MG, Gündoğan K. NRS-2002 and mNUTRIC score: Could we predict mortality of hematological malignancy patients in the ICU?. Nutrition in Clinical Practice. 2022 Oct;37(5):1199-205.
17. Tripathi H, Benjamin J, Maiwall R, Puri P, Kapoor PB, Shasthry V, Saluja V, Agrawal P, Kumar G, Joshi YK, Sarin SK. Identifying critically ill patients with cirrhosis who benefit from nutrition therapy: the mNUTRIC score study. Journal of Clinical and Translational Research. 2022 Oct 10;8(5):425.
18. Servia-Goixart L, Lopez-Delgado JC, Grau-Carmona T, Trujillano-Cabello J, Bordeje-Laguna ML, Mor-Marco E, Portugal-Rodriguez E, Lorencio-Cardenas C, Montejo-Gonzalez JC, Vera-Artazcoz P, Macaya-Redin L. Evaluation of Nutritional Practices in the Critical Care patient (The ENPIC study): Does nutrition really affect ICU mortality?. Clinical Nutrition ESPEN. 2022 Feb 1;47:325-32.
19. Kasapoglu US, Gok A, Delen LA, Ozer AB. Comparison of nutritional risk status assessment tools in predicting 30-day survival in critically ill COVID-19 pneumonia patients. Annals of Saudi Medicine. 2022 Jul;42(4):236-45.