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Modified NUTRIC Score and Nutritional Adequacy in Relation to Mechanical Ventilation Duration in Critically Ill Adults: A Prospective Observational Study

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Abstract

Background and Aim: Patients in the Intensive Care Unit (ICU) are particularly vulnerable to malnutrition because of inadequate nutritional intake and underlying critical illness. The modified Nutrition Risk in the Critically Ill (mNUTRIC) score was created to evaluate critically ill patients. This study aimed to assess the association between mNUTRIC score, energy and protein adequacy, and duration of mechanical ventilation in critically ill patients.

Patients and Methods: A prospective observational correlational study was conducted among 100 adult ICU patients who had completed at least 48 hours of invasive mechanical ventilation. Consecutive sampling was used to recruit eligible participants. The mNUTRIC score was calculated after completion of 48 hours of mechanical ventilation, and energy and protein adequacy were assessed in relation to the prescribed nutritional targets.

Results: Among 100 mechanically ventilated ICU patients, 53% had high mNUTRIC scores. The mNUTRIC score showed a strong positive correlation with MV duration (ρ = 0.69, 95% CI 0.54–0.79, $p < 0.001$). Protein adequacy (ρ = −0.06, p = 0.556) and energy adequacy (ρ = −0.05, p = 0.646) were not significantly associated with MV duration. In multivariable regression, the mNUTRIC score remained significantly significantly associated with MV duration (β = 0.62, $p < 0.001$).

Conclusion: Higher mNUTRIC scores were significantly associated with longer MV duration in this cohort. No statistically significant association between energy or protein adequacy and MV duration was demonstrated. These findings support the use of nutritional risk assessment in critically ill patients, while the potential impact of targeted nutritional interventions on MV duration requires evaluation in future interventional studies.

Keywords: mNUTRIC Score, Adequacy of Energy and Protein, ICU, Mechanical Ventilation

1. Introduction

Critical illness is characterized by profound physiological stress, hypermetabolism, and catabolism, which increase metabolic demands and accelerate tissue breakdown [1]. Under these conditions, adequate nutritional support is an important component of critical care. Adequate delivery of macronutrients, particularly energy and protein, plays a central role in preserving lean body mass, maintaining immune competence, and facilitating recovery [2]. However, malnutrition in the intensive care unit (ICU) has been consistently associated with adverse outcomes, including infectious complications, delayed wound healing, mechanical ventilation (MV), and increased mortality. Despite these recognized consequences, malnutrition remains a common and often underdiagnosed challenge in critically ill patients because of sedation, organ dysfunction, and the complexities of critical care delivery [3].

Professional societies such as the American Society for Parenteral and Enteral Nutrition (ASPEN) and the European Society for Clinical Nutrition and Metabolism (ESPEN) recommend initiating nutrition therapy within 24–48 hours of ICU admission. However, implementation of these recommendations in clinical practice may be limited, with many patients receiving suboptimal protein and energy intake [4]. The problem is particularly relevant among patients requiring MV, who represent a

vulnerable subgroup. Patients requiring prolonged MV may be at increased risk of skeletal and diaphragmatic muscle wasting, which may contribute to prolonged ICU stay and delayed rehabilitation [5]. Although adequate protein intake may support preservation of respiratory muscle function and contribute to ventilator liberation, and appropriate energy delivery may help attenuate catabolism, evidence regarding the association between nutritional adequacy and MV duration remains inconsistent [6].

Critical illness is also associated with metabolic and inflammatory changes that can affect nutritional status. Systemic inflammation, oxidative stress, and increased protein catabolism can lead to loss of skeletal muscle mass [7]. The respiratory muscles, particularly the diaphragm, may also be affected, which can contribute to difficulty in weaning from mechanical ventilation and delayed recovery [8]. The mNUTRIC score includes variables related to age, comorbidities, and severity of illness and is used to identify patients at higher nutritional risk; however, it is not a direct measure of nutritional status. Therefore, assessment of nutritional risk may be useful when evaluating patients at risk of prolonged mechanical ventilation [9].

To address the limitations of traditional nutritional screening in critically ill patients, Heyland and colleagues introduced the Nutrition Risk in the Critically Ill (NUTRIC) score. The tool combines demographic characteristics, comorbidities, and indicators of illness severity to identify patients at higher nutritional risk who may require closer nutritional assessment and management. NUTRIC and mNUTRIC are based on the same concept of assessing nutritional risk in critically ill patients; mNUTRIC is a modified version that excludes the Interleukin-6 (IL-6) variable, making it more practical for routine ICU use when IL-6 measurements are not available. High mNUTRIC scores have been associated with increased mortality and longer ICU stays across different critically ill populations [10]. However, the relationship between mNUTRIC-defined nutritional risk and MV duration, as well as the relationship between nutritional adequacy and MV duration, remains insufficiently explored, particularly in resource-constrained settings where achieving nutritional targets may be challenging.

Although many studies have reported an association between NUTRIC score and mortality, ICU length of stay, and other adverse clinical outcomes, evidence regarding its association with mechanical ventilation duration remains limited and inconsistent [11]. Furthermore, previous investigations have often examined nutritional risk or nutritional adequacy separately, with relatively few studies evaluating the associations of mNUTRIC score, protein adequacy, and energy adequacy with MV duration. Studies from resource-constrained healthcare settings are particularly limited, where achieving nutritional targets may be challenging [12]. Therefore, an important knowledge gap remains regarding the relationship between nutritional risk, nutritional adequacy, and MV duration in critically ill patients.

The present study therefore aimed to investigate the association between mNUTRIC score, nutritional adequacy, and MV duration in a cohort of ICU patients. The findings may help inform future research and clinical evaluation of nutritional risk and nutritional adequacy in mechanically ventilated patients.

2. Patients and Methods

2.1 Study design and setting

A prospective observational correlational study was conducted in a mixed adult intensive care unit (ICU) of a selected tertiary-care hospital in Pune, Maharashtra, India. The study examined the associations between nutritional risk, nutritional adequacy, and duration of mechanical ventilation among critically ill adult patients. Data were collected prospectively using standardized data collection procedures.

2.2 Participants

Eligible participants were adults (≥18 years) of either sex who required invasive mechanical ventilation for at least 48 hours and received either enteral or parenteral nutrition. Patients with hemodynamic instability precluding initiation of nutrition therapy or those with "Do Not Resuscitate" orders were excluded. Written informed consent was obtained from patients or their legally authorized representatives when patients were unable to provide consent.

2.3 Sample size and sampling:

Sample size calculation:

The sample size was determined using the single population proportion formula:

$$n = \frac{Z^2 \times p(1-p)}{MOE^2}$$

Where n is the required sample size, Z is the standard normal deviate corresponding to a 95% confidence level (1.96), p is the anticipated prevalence (0.396), and MOE is the margin of error (0.10).

Substituting these values:

$$n = (1.96)^2 \times 0.396 \times (1 - 0.396) / (0.10)^2$$

$$n = 91.90, \text{ approximately 92 participants.}$$

To ensure an adequate sample, a total of 100 participants were included in the study.

The calculation was based on estimation of a proportion rather than on the expected correlation between mNUTRIC score and MV duration. Consecutive sampling was used, and all eligible patients meeting the inclusion criteria during the study period were recruited until the required sample size was achieved.

2.4 Measures

1. **Demographics and clinical data:** Age, sex, Body Mass Index (BMI), underlying comorbidities, ICU length of stay, and duration of mechanical ventilation were obtained from patient records. Clinical factors that may influence mechanical ventilation duration, including vasopressor use, renal replacement therapy, acute respiratory distress syndrome (ARDS), and sedation, were not systematically collected. No separate ICU severity-of-illness score, such as APACHE II or SOFA, was collected or included in the analysis.
2. **Nutritional risk:** The Modified Nutrition Risk in the Critically Ill (mNUTRIC) score (range: 0–9) was

calculated for each participant using validated scoring criteria. Scores were categorized as low risk (0–4) and high risk (5–9). The 48-hour assessment was counted from the initiation of invasive mechanical ventilation, regardless of the time elapsed since ICU admission. The timing of initiation of nutritional therapy was recorded separately because it varied according to individual clinical status and treatment requirements.

3. **Duration of mechanical ventilation:** Duration of mechanical ventilation (MV) was defined as the number of days from initiation of invasive mechanical ventilation until complete liberation from ventilatory support. Tracheostomy alone was not considered liberation from mechanical ventilation; patients remained classified as receiving MV until ventilatory support was completely discontinued. If reintubation occurred after extubation, the subsequent period of invasive mechanical ventilation was also considered in determining the total duration of MV.
4. **Nutritional adequacy:** Individual energy and protein targets were calculated using the participant's actual body weight. The energy target was estimated at 20–25 kcal/kg/day, while the protein target was estimated at 1.2–2.0 g/kg/day. Total daily energy and protein intake were recorded for each participant and compared with the respective calculated targets to assess nutritional adequacy. No adjustments were made for Body Mass Index, ideal body weight, adjusted body weight, or other special clinical conditions. Energy and protein adequacy were expressed as the percentage of the calculated target achieved during the 72-hour assessment period.
5. **Primary Outcome:** Nutritional adequacy was assessed over a 72-hour stabilization period after initiation and stabilization of nutritional therapy. This early nutritional exposure was examined in relation to the overall duration of mechanical ventilation, measured from initiation of invasive mechanical ventilation until complete liberation from ventilatory support. The 72-hour assessment was intended to capture early nutritional delivery and may not fully represent cumulative nutritional exposure in patients who required prolonged mechanical ventilation. Nutritional intake and feeding interruptions beyond this assessment period were not systematically captured. Therefore, the temporal relationship between nutritional adequacy and the subsequent course of mechanical ventilation should be interpreted cautiously.

2.5 Data collection procedures

Complete nutritional intake data were available for all participants included in the analysis, and no imputation for missing nutritional data was required. No participant died before completion of the 72-hour nutritional assessment.

2.6 Statistical analysis

Data were analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY). Continuous variables were summarized using mean ± standard deviation (SD) or median and interquartile range (IQR), as appropriate, while categorical variables were presented as frequencies and percentages. Spearman's rank correlation was used to examine the relationships between MV duration and mNUTRIC score, energy adequacy, and protein adequacy. Multivariable linear regression was used to examine the association of mNUTRIC score, energy adequacy, and protein adequacy with MV duration. Because age and comorbidity burden are components of the mNUTRIC score, these variables were not entered separately into the regression model to avoid overlap.

3. Results

3.1 Participant characteristics

Table 1: A total of 100 ICU patients were enrolled in the study. The majority were middle-aged (48% between 38–58 years), with a slight male predominance (57%). More than half (57%) had a normal BMI, while 15% were underweight and 28% overweight/obese. Nearly all patients (99%) received enteral nutrition. ICU stay (>7 days) was observed in 42% of participants. Detailed demographic and clinical data are shown in the Table 1.

Table 1: Demographic and Clinical Characteristics **N = 100**

Variable	N	%
Age (years)		
18–38	21	21
38–58	48	48
58–78	18	18
>78	13	13
Sex		
Male	57	57
Female	43	43
BMI		
Normal	57	57
Overweight/Obese	28	28
Underweight	15	15
ICU stay >7 days	42	42
Nutrition route		
Enteral	99	99
Parenteral	1	1

(N- Sample size, BMI- Body Mass Index, ICU- Intensive Care Unit)

Nutritional risk and adequacy

Table 2: More than half of the cohort (53%) had a high modified NUTRIC score (5–9). Half of the patients achieved energy adequacy (≥80% of prescribed target), while protein adequacy was considerably lower, with only 31% of patients meeting targets. Overall, 69% of the cohort remained protein deficient despite early enteral feeding.

Table 2: Nutritional risk and adequacy **N = 100**

Measure	Category	n	%
mNUTRIC score	High (5–9)	53	53
	Low (0–4)	47	47
Energy intake	Adequate (≥80%)	50	50
	Inadequate (<80%)	50	50
Protein intake	Adequate (≥80%)	31	31
	Inadequate (<80%)	69	69

(N- Sample size, n- sample size of a particular subgroup, mNUTRIC score- Modified Nutrition Risk in the Critically Ill)

Table 3: Cross-tabulation demonstrated that patients with high mNUTRIC scores were significantly less likely to achieve protein adequacy compared with low-risk patients (20.8% vs. 42.6%, p = 0.028). Energy adequacy did not differ significantly between risk groups (p = 0.317).

Table 3: Cross-tabulation of mNUTRIC risk and nutritional adequacy **N = 100**

Adequacy	Low Risk (n=47)	High Risk (n=53)	*p*-value*
Energy adequacy	26 (55.3%)	24 (45.3%)	0.317
Protein adequacy	20 (42.6%)	11 (20.8%)	0.028*

(N- Sample size, n- sample size of a particular subgroup, *Fisher's exact test)

3.2 Mechanical ventilation duration

Table 4: The mean duration of mechanical ventilation (MV) was 5.8 ± 2.4 days (range: 2–14 days). Nearly half of the patients (45%) required ventilation for 48–72 hours, while others required longer ventilation.

Correlation analysis revealed a strong positive association between NUTRIC score and MV duration (Spearman's ρ = 0.69, 95% CI 0.54–0.79, p < 0.001). In contrast, energy adequacy (ρ = –0.05, p = 0.646) and protein adequacy (ρ = –0.06, p = 0.556) demonstrated weak, non-significant negative correlations with MV duration (**Table 4**).

Table 4: Correlations with MV duration **N = 100**

Variable	Spearman's ρ	95% CI	*p*-value
mNUTRIC score	0.69	0.54 – 0.79	<0.001**
Energy adequacy	–0.05	–0.24 – 0.15	0.646
Protein adequacy	–0.06	–0.25 – 0.14	0.556

(N- Sample size, CI – Confidence Interval)

3.3 Multivariable regression analysis

Table 5: A multivariable linear regression model was used to examine the association of mNUTRIC score, energy adequacy, and protein adequacy with MV duration. The mNUTRIC score was significantly associated with MV duration (β = 0.62, SE = 0.09, p < 0.001), whereas energy adequacy (β = −0.06, SE = 0.12, p = 0.51) and protein adequacy (β = −0.07, SE = 0.11, p = 0.49) were not significantly associated with MV duration. The adjusted R^2 was 0.47.

Table 5: Multivariable Linear Regression Analysis of Factors Associated with MV Duration Adjusted R^2 = 0.47 **N = 100**

Predictor	β (Std. Coeff.)	SE	*p*-value
mNUTRIC score	0.62	0.09	<0.001**
Energy adequacy	–0.06	0.12	0.51
Protein adequacy	–0.07	0.11	0.49

(N = total sample size; β = standardized regression coefficient (Beta); SE = standard error; p = *p*-value)

3.4 Discussion

This study examined the relationship between nutritional risk, nutritional adequacy, and mechanical ventilation (MV) duration in critically ill patients. The findings showed that higher mNUTRIC scores were significantly associated with longer MV duration. In contrast, no significant association between protein or energy adequacy and MV duration was demonstrated in this study. These findings highlight the potential value of nutritional risk assessment in critically ill patients, while the effect of nutritional interventions on MV duration requires further investigation.

NUTRIC score and its association with MV duration

The strong positive correlation between mNUTRIC score and MV duration (ρ = 0.69, p < 0.001) indicates a significant association between higher nutritional risk and longer MV duration in this study. The mNUTRIC score incorporates age, comorbidities, and indicators of illness severity and therefore reflects both nutritional risk and the overall vulnerability of critically ill patients. Previous studies have consistently reported associations between higher mNUTRIC scores and mortality and other adverse outcomes in critically ill patients [10]. Some studies have also reported an association between higher mNUTRIC scores and longer mechanical ventilation, although findings across studies have not been entirely consistent. Evidence from other nutritional risk tools, such as NRS-2002, also suggests a relationship between nutritional risk and adverse outcomes; however, these findings should not be considered direct evidence for mNUTRIC. In the present study, higher mNUTRIC scores were associated with longer MV duration after adjustment for the variables included in our model. Because mNUTRIC incorporates indicators of illness severity, the observed association may partly reflect the severity of underlying critical illness. Therefore, the findings should be interpreted as an association rather than evidence that nutritional risk itself causes prolonged mechanical ventilation.

Nutritional adequacy and MV duration

In contrast, no significant association between protein or energy adequacy and MV duration was demonstrated in this study. This finding is consistent with previous studies reporting inconsistent associations between short-term nutritional adequacy and ventilator outcomes [13, 14]. In contrast, Lee *et al*. in a prospective observational study reported an association between nutritional adequacy and 28-day mortality among critically ill patients with high mNUTRIC scores, particularly during the late metabolic phase [15]. Similarly, Siaw-Frimpong *et al*., in a prospective observational study involving a mixed ICU population, reported that patients with a high mNUTRIC score had fewer ICU-free days and higher mortality. However, early versus delayed initiation of nutrition was not associated with a significant difference in ICU-free days [16]. Several factors may explain these findings. The biological effects of nutritional intake may require a longer period to become evident, whereas our assessment was limited to a 72-hour period after initiation and stabilization of feeding. In addition, feeding interruptions, feeding intolerance, and differences in clinical condition may have affected the amount of nutrition delivered. Therefore, the absence of a statistically significant association in this study should not be interpreted as evidence that energy or protein intake does not affect MV duration. Longer-term studies with cumulative assessment of nutritional intake may provide further insight into this relationship.

Protein deficit as a clinical concern

The high prevalence of protein inadequacy (69%) observed in this cohort reflects a gap in protein delivery among mechanically ventilated ICU patients. Adequate protein intake is important for maintaining lean body mass and supporting muscle function during critical illness [17]. Supporting this concern, Parasuraman *et al*. in a randomized double-blind study involving mechanically ventilated critically ill patients reported significantly greater preservation of skeletal muscle thickness and cross-sectional area in patients receiving high-protein feeding compared with standard-protein feeding [18].

However, although protein adequacy was not significantly

associated with MV duration in this study, the high proportion of patients who did not meet the calculated protein targets remains clinically relevant [19]. However, the clinical benefits of higher protein provision remain uncertain. Zhou *et al*., in a systematic review and meta-analysis of randomized controlled trials, found that higher protein provision did not significantly reduce mechanical ventilation duration or mortality among critically ill adults, although it was associated with improved early nitrogen balance [20]. Regular monitoring of protein intake and attention to feeding interruptions may help healthcare teams identify and address nutritional gaps. Whether strategies aimed at improving protein delivery can influence MV duration requires further investigation.

Implications for critical care nursing and practice

An early-warning approach to identifying enteral feeding intolerance has also been described in nursing practice, emphasizing systematic risk assessment and early recognition of feeding-related problems [21]. The findings may have implications for nursing practice and inter-professional collaboration. Nurses play an important role in ICU nutrition care, including monitoring feeding tolerance, recording nutritional intake, and minimizing avoidable interruptions. Supporting this role, Zheng *et al*., in a multicentre study of critically ill patients, found that interruptions in enteral nutrition were associated with reduced energy and protein intake, highlighting the importance of nursing measures to prevent avoidable feeding interruptions [22]. Incorporating mNUTRIC assessment into routine clinical evaluation may help identify patients at higher nutritional risk [23]. Structured nutrition monitoring and multidisciplinary nutrition care may help identify nutritional gaps; however, the present observational findings cannot establish whether these approaches improve MV outcomes. A recent scoping review by He *et al*. further emphasized the role of nurse-led interventions, including standardized feeding protocols, structured nutritional monitoring, and multidisciplinary collaboration, in reducing enteral nutrition interruptions and improving nutritional delivery in critically ill patients [24]. Prospective interventional studies are needed to determine whether targeted nutritional strategies can influence MV duration.

Strengths of the study

The strengths of this study include its prospective design, standardized data collection, and use of a validated nutritional risk assessment tool. The inclusion of mechanically ventilated adult ICU patients provides a clinically relevant population for examining the relationships between nutritional risk, nutritional adequacy, and mechanical ventilation duration. The use of correlation and multivariable regression analyses enabled these relationships to be examined using complementary statistical approaches.

Limitations and directions for future research

Limitations should be considered when interpreting the findings. First, the study was conducted at a single centre with a relatively small sample size, which may limit the generalizability of the results. The sample size was calculated based on an estimated proportion rather than the expected association between study variables. Second, nutritional adequacy was assessed over a 72-hour period and may not reflect nutritional intake throughout the entire period of mechanical ventilation. Nutritional requirements were estimated using actual body weight and predefined targets, which may not fully account for individual variations in nutritional needs. Third, important clinical factors, including illness severity scores (APACHE II or SOFA), vasopressor use, renal replacement therapy, acute respiratory distress syndrome, and sedation, were not systematically collected; therefore, residual confounding cannot be excluded. Finally, mortality was not analysed as a competing outcome, which may influence the interpretation of mechanical ventilation duration in critically ill patients. Future multicentre studies with larger samples, longer-term nutritional assessments, and comprehensive adjustment for illness severity and other clinical factors are warranted to validate these findings.

4. Conclusion

In summary, higher mNUTRIC scores were strongly and significantly associated with longer MV duration in this cohort. No statistically significant association between energy or protein adequacy and MV duration was demonstrated in this study, although protein inadequacy was common. Routine mNUTRIC assessment may help identify patients at higher nutritional risk; however, whether targeted nutritional strategies can reduce MV duration requires confirmation through well-designed interventional studies.

5. Declaration

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Ethical considerations

Ethical approval for the study was granted by the Research and Ethics Committee of Smt. Bakul Tambat Institute of Nursing Education, Karve Nagar, Pune, Maharashtra, India 411052, on 20 October 2023 (Reference No. 609/INE/2023). Institutional permission to conduct the research was also obtained. Written informed consent was obtained from all participants or their legally authorized representatives before data collection. All procedures were conducted in accordance with the Declaration of Helsinki.

Clinical Trial Registration

Not applicable.

6. References

1. Stanojcic M, Finnerty CC, Jeschke MG. Anabolic and anticatabolic agents in critical care. Curr Opin Crit Care. 2016; 22:325-331.

2. Atherton PJ, Smith K. Muscle protein synthesis in response to nutrition and exercise. J Physiol. 2012; 590:1049-1057.
3. Lew CCH, Yandell R, Fraser RJL, *et al*. Association between malnutrition and clinical outcomes in the intensive care unit: A systematic review. JPEN J Parenter Enteral Nutr. 2017; 41:744-758.
4. Davies C, Johansson L, Brett SJ, *et al*. Enteral nutrition delivery in patients admitted to a critical care unit following major trauma: Who's at risk and what's the impact? J Intensive Care Soc. 2025; 26:435-445.
5. Fuentes Padilla P, Martínez G, Vernooij RW, *et al*. Early enteral nutrition (within 48 hours) versus delayed enteral nutrition (after 48 hours) with or without supplemental parenteral nutrition in critically ill adults. Cochrane Database Syst Rev, 2019, CD012340.
6. Carbone JW, Pasiakos SM. Dietary protein and muscle mass: translating science to application and health benefit. Nutrients. 2019; 11:1136.
7. Rousseau AF, Martindale R. Nutritional and metabolic modulation of inflammation in critically ill patients: A narrative review of rationale, evidence and grey areas. Ann Intensive Care. 2024; 14:121.
8. Hartl WH, Kopper P, Xu L, *et al*. Relevance of protein intake for weaning in the mechanically ventilated critically ill: Analysis of a large international database. Crit Care Med. 2024; 52:e121-e131.
9. Renuka MK, Arunkumar AS. Use of nutrition risk in critically ill (NUTRIC) score to assess nutritional risk in mechanically ventilated patients: A prospective observational study. Indian J Crit Care Med. 2017; 21:253-256.
10. Xie M, Huang L, Li L, *et al*. Association between NUTRIC score and ICU mortality in patients with sepsis: A prospective cohort study. Front Nutr. 2025; 12:1654901.
11. Mahmoodpoor A, Sanaie S, Sarfaraz T, *et al*. Prognostic values of modified NUTRIC score to assess outcomes in critically ill patients admitted to the intensive care units: Prospective observational study. BMC Anesthesiol. 2023; 23:131.
12. Verheul EAH, Koole D, Dijkink S, *et al*. Association of modified NUTRIC score for nutritional risk and in-hospital developed malnutrition in adults with severe injuries: A prospective observational cohort study. Eur J Trauma Emerg Surg. 2025; 51:214.
13. Lee ZY, Noor Airini I, Barakatun-Nisak MY. Relationship of energy and protein adequacy with 60-day mortality in mechanically ventilated critically ill patients: A prospective observational study. Clin Nutr. 2018; 37:1264-1270.
14. Lin PY, Yen YT, Lu MJ, *et al*. Association between energy adequacy and clinical outcomes in septic intensive care unit patients stratified by modified Nutrition Risk in the Critically Ill score. J Chin Med Assoc. 2026; 89:634-641.
15. Lee GH, Kim YJ, Park SH, *et al*. Application of metabolic phase-specific modified nutrition risk in critically ill score: A prospective observational study in critically ill patients. Front Nutr. 2024; 11:1367727.
16. Siaw-Frimpong M, Korula PJ, Karuppusami R, *et al*. Combined effect of the timing of initiation of nutrition and nutrition risk on outcomes in a mixed intensive care unit of a tertiary hospital in a middle-income country. Indian J Crit Care Med. 2025; 29:137-142.
17. Paulus MC, Kouw IWK, Van Beek-Westeneng N, *et al*. The impact of an individually tailored, stepwise nutrition protocol on energy and protein adequacy in post-ICU patients: The PROSPECT-II observational cohort study. Clin Nutr. 2025; 54:120-131.
18. Parasuraman V, Anand RK, Khanna P, *et al*. Effect of high protein normocaloric nutrition on skeletal muscle wasting in critically ill mechanically ventilated patients: A randomized double-blind study. Indian J Crit Care Med. 2025; 29:431-440.
19. Chang CH, Lin CY, Lo YL, *et al*. Higher protein intake may benefit patients with prolonged mechanical ventilation. Front Nutr. 2024; 11:1449240.
20. Zhou Y, Hao X, Pan R, *et al*. Efficacy and safety of higher versus lower protein provision with meaningful dose separation in critically ill adults: A systematic review and meta-analysis of randomized controlled trials. Front Nutr. 2026; 13:1893988.
21. Wełna M, Adamik B, Kübler A, *et al*. The NUTRIC score as a tool to predict mortality and increased resource utilization in intensive care patients with sepsis. Nutrients. 2023; 15:1648.
22. Zheng H, Cai L, Wang P, *et al*. Causes and impacts of interrupted enteral nutrition in critically ill patients: A secondary analysis of a cluster-randomized controlled trial. Nurs Crit Care. 2025; 30:e70006.
23. Zlojutro B, Majstorovic G, Jandric M, *et al*. Modified NUTRIC score and clinical outcomes in critically ill medical patients: A prospective cohort study in Bosnia and Herzegovina. Biomol Biomed, 2026. Ahead of print.
24. He Q, Qian J, Miao M, *et al*. Interruptions of enteral nutrition in intensive care units: Mechanisms, clinical impacts, and precision nursing interventions: A scoping review. Front Nutr. 2026; 13:1768983.