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The Modified Nutrition Risk in Critically III (mNUTRIC) Score associated with Clinical Outcome and Length of Stay in Intensive Care Unit (ICU) Patients

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ABSTRACT
Background: Malnutrition is a common issue in hospital settings, particularly in the ICU and among elderly patients. **Objective:** This study aimed to analyze the nutritional characteristics of ICU patients and their association with clinical outcomes and length of stay. **Methods:** This observational cross-sectional and prospective study was conducted in the ICU of Dr. H. Abdul Moeloek Hospital, Lampung Province, from December 2023 to February 2024. Patients hospitalized during this period were the study population, with total sampling used to collect data. The mNUTRIC score was employed to assess nutritional status. Bivariate analysis using chi-square was conducted to analyze the association between mNUTRIC scores and patient outcomes, as well as length of stay. **Results:** The majority of patients were elderly aged 50-75 years (45%) and female (95%). A significant portion (68.3%) had an abnormal body mass index (underweight, overweight, or obese). Additionally, 91.7% had comorbidities, and most stayed in the ICU for more than three days, with 51.7% having extended stays. Furthermore, 48.3% passed away during hospitalization. The study found that 51.7% of patients were at high nutritional risk, while 48.3% were at low risk. Bivariate analysis revealed a significant correlation between mNUTRIC score and clinical outcomes, including length of stay ($p<0.05$) **Conclusion:** The study highlights the importance of nutritional screening in identifying malnourished ICU patients who were predominantly older, which is associated with clinical outcomes and length of stay.

INTRODUCTION

Malnutrition is a prevalent condition in hospital settings, marked by inadequate nutritional intake that disrupts body composition, impairs physical and mental functions, and contributes to unfavorable clinical outcomes.(1) It has a significant impact on various health indicators, including length of stay (LOS), morbidity and mortality rates, readmissions, and the incidence of infections (IOI).(2–4)

The prevalence of malnutrition in hospitals is alarmingly high. Studies indicate that approximately one in three hospitalized patients is malnourished, and two-thirds of initially well-nourished patients are at risk of developing malnutrition during their stay.(5) This issue is particularly severe in Intensive Care Units (ICUs), where malnutrition rates range from 38% to 78% in international studies and 33% to 70% in Indonesian studies.(2,5–7)

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Older adults are particularly vulnerable, comprising nearly 50% of ICU patients and facing a significantly higher risk of malnutrition compared to younger individuals.(3,8) This vulnerability stems from age-related regression in biological, physical, and psychological functions, which exacerbates the severity of their illnesses and increases the likelihood of malnutrition.(9) Malnutrition in elderly ICU patients leads to severe consequences, including higher rates of complications and infections, prolonged ICU stays, and increased mortality.(10)

Various tools are used to assess nutritional status, such as the Nutritional Risk Screening 2002 (NRS-2002), the Malnutrition Universal Screening Tool (MUST), Subjective global assessment (SGA) and the Nutrition Risk in the Critically ill (NUTRIC) Score, among others.(1,5,11,12) The choice of assessment tools depends on the patient's condition.

For critically ill patients in the ICU, the NUTRIC score or its modified version (mNUTRIC) is a validated screening tool that guides the provision of nutritional support. (11,13) mNUTRIC score best tools to predict mortality, moreover this tools can use to predicting energy requirement.(11)

This study aimed to analyze the nutritional characteristics of patients in the ICU at Dr. H. Abdul Moeloek Hospital, the main referral hospital in Lampung Province, using mNUTRIC score and to examine their association with patient outcomes and length of stay.

METHODS
Study Design
This was an observational study with no intervention on the variables studied. The approach used was cross-sectional and prospective. The study was conducted in the Intensive Care Unit (ICU) of Dr H. Abdul Moeloek Hospital, Lampung Province during the period December 2023 - February 2024. Data were collected prospectively by tracing secondary data, namely patients' medical records.

Population and Samples
The sampling technique used was the total sampling method, with sample selection based on criteria. The desired inclusion criteria were patients aged ≥18 years and being treated in the ICU for >24 hours. Exclusion criteria included patients with incomplete medical records, pregnant patients, and patients who died within ≤3 days.

Nutritional Assessment
Data analysis was performed by screening patients' nutritional status using the mNUTRIC score 24 hours after admission to the ICU.(12,14)

mNUTRIC calculate using 6 variables, namely aged, APACHE II, SOFA score, number of Co-morbidities, days from hospital to ICU admission and interleukin-6 (IL-6), however assessment can conducted without IL-6. (5,12) In this study, mNUTRIC was assessed without IL-6 data. (**Table 1**)

Table 1. mNUTRIC Score Variables

Variable	Range	Points
Age	<50	0
	50 - <75	1
	≥75	2
APACHE II	<15	0
	15 - <20	1
	20 – 28	2
	≥28	3
SOFA	<6	0
	6 - <10	1
	≥10	2
Number of Co-morbidities	0 – 1	0
	>1	1
Days from hospital to ICU admission	0 - <1	0
	≥1	1

The final nutritional status was determined by calculating scores from five variables. Patients with scores ranging from 5 to 9 are categorized as high risk, while those with scores from 0 to 4 are categorized as low risk. (5) The cut-off points for the mNUTRIC score are presented in **Table 2**.

Table 2. mNUTRIC scoring system: If no IL-6 available*

Sum of Points	Category	Explanation
5 – 9	High Score	- Associated with worse clinical outcomes (mortality and ventilation) - These patients are the most likely to benefit from aggressive nutritional therapy
0 – 4	Low Score	- These patients have a low malnutrition risk

Data Analysis
An analytical research design using Statistical Package for the Social Sciences (SPSS) software was used to identify the correlation between mNUTRIC score and caloric adequacy as well as LOS of patients through chi-square analysis.

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RESULTS

In this study, the characteristics of patients were dominated by elderly aged 50-75 years (45%) and females (95%). A significant portion of the patients (68.3%) had an abnormal body mass index, including underweight, overweight, or obesity. Additionally, 91.7% of the patients had comorbidities. The majority of patients stayed in the ICU for more than three days, with 51.7% remaining in the ICU for extended periods. Furthermore, 48.3% of the patients passed away during hospitalization. **Table 1** shows the characteristics of patients in the ICU room.

Table 3. The characteristics of patients in the ICU room of Dr H. Abdul Moeloek Hospital

Variabel	N	Percent
Aged		
< 50 years	26	43.3%
50-75 years	27	45%
>75 years	7	11.7%
Gender		
Female	33	55%
Male	27	45%
Body Mass Index (BMI)		
Underweigh (<18,5kg/m^2)	4	6.7%
Normal (18,5-22,9kg/m^2)	19	31.7%
Overweight (23-24.9 kg/m^2)	14	23.3%
Obesitas 1 (25-29.9 kg/m^2)	18	30%
Obesitas 2 (≥30 kg/m^2)	5	8.3%
Comorbid		
Yes	55	91.7%
No	5	8.3%
Length of Stay (LOS)		
≤ 3 days	23	38.3%
> 3 days	37	61.7%
Outcome		
Transferred	31	51.7%
Death	29	48.3%

This study used five variables to assess nutrition using the mNUTRIC tool. **Table 4** describes the distribution of data related to these variables. The APACHE II score was predominantly in the range of 20-27, while the SOFA score was mostly between 6-9. Additionally, 71.7% of patients had more than one comorbidity, and 96.7% of patients were admitted to the ICU more than one day after being hospitalized.

Table 4. Distribution Data for mNUTRIC Score Variables

Variable	N	Percent
Aged		
< 50 years	26	43.3%
50-75 years	27	45%
>75 years	7	11.7%
APACHE II Score		
0 – 14	10	16.7%
15 – 19	18	30%
20 – 27	21	35%
≥28	11	18.3%
SOFA Score		
0–5	23	38.3%
6–9	22	55%
≥10	4	6.7%
Number of Comorbid		
0-1	17	28.3%
> 1	43	71.7%
Length of Stay (LOS)		
0 days	2	3.3%
≥ 1 days	58	96.7%

After obtaining scores from the five variables in Table 4, the mNUTRIC score was assessed. This study found that 51.7% of patients were categorized as high risk, while 48.3% were categorized as low risk for malnutrition. In other words, 51.7% of patients were in a malnutrition situation in the ICU of Dr. H. Abdul Moeloek Hospital. **Table 5** presents the mNUTRIC score assessment, illustrating the nutritional risk levels of these patients.

Table 5. mNUTRIC score assessment

Variable	N	Percent
mNUTRIC Score		
Low Risk (0 – 4)	29	48.3%
High Risk (5 – 9)	31	51.7%

Bivariate analysis revealed a significant correlation between mNUTRIC score and patient outcomes, as well as length of stay in the ICU (p value < 0.05). **Table 6** describes that high-risk nutrition patients had a higher percentage of mortality (80.65%) and longer LOS in the hospital (74.19%). In contrast, patients with low-risk nutrition had a higher percentage of being transferred to a stable room (86.20%) and shorter ICU stays (51.72%).

Table 6. The bivariate analysis between the mNUTRIC score and patient outcomes, as well as length of stay

Variables	mNUTRIC Score				P value
	Low Risk		High Risk		
	N	Percent	N	Percent	
Outcome					
Death	4	13.80%	25	80.65%	0.000
Transferred	25	86.20%	6	19.35%	
Length of Stay					
≤ 3 days	15	51.72%	8	25.81%	0.039
> 3 days	14	48.28%	23	74.19%	

DISCUSSION

This study revealed that 51.7% of ICU patients assessed using the mNUTRIC score were categorized as high risk. This finding underscores the association

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between high mNUTRIC scores and poorer clinical outcomes, highlighting the urgent need for prompt and aggressive nutritional therapy to improve patient prognosis.

Nutritional care for ICU patients is often underprioritized despite its critical role in patient outcomes. Indonesian Ministry of Health guidelines emphasize conducting nutritional assessments within 24–48 hours of ICU admission, reinforcing the importance of timely evaluations. Early nutritional assessment determines the appropriate timing for initiating and ensuring adequate nutritional support.(15,16)

The mNUTRIC score stands out as a reliable and practical tool for ICU nutritional assessment, leveraging readily accessible variables. Unlike tools such as the SGA, which require anthropometric and muscle function measurements, the mNUTRIC score is more feasible in high-pressure ICU settings.(5,17) However, for patients at high nutritional risk, specialized care from a nutritionist or dietitian is recommended.(5) This study utilized the mNUTRIC score for its practicality in assessing critically ill patients' nutritional status effectively.

This study aligns with previous research showing ICU populations are often dominated by elderly patients and females with abnormal body mass indices and comorbidities.(13,18–20) However, studies in Purwakarta, Tasikmalaya, and Uganda noted adults as the predominant ICU demographic, with elderly patients ranking second. In contrast, research from Hong Kong highlighted a predominance of elderly men in ICUs.(7,20,21)

The increased ICU admission rates among the elderly are attributed to physiological changes such as immune dysregulation and reduced respiratory capacity, exacerbated by comorbid conditions and the increased complexity of medical issues in this demographic.(22–24)

Although males often dominate ICU use, estrogen's protective role in females explains why premenopausal women may have lower ICU admission rates. Women especially postmenopausal, however, face increased risks of hospitalization and worse outcomes compared to men.(19,25,26)

Medical outcome and LOS in the ICU is influenced by factors such as age, medical history, diagnosis, and illness severity. This study found that most patients remained in the ICU for more than three days, consistent with other studies. However, research in Tasikmalaya reported most ICU stays lasting 1–3 days.(7,18) Elderly patients are 4.8 times more likely to have extended ICU stays, especially when malnourished.(21) Additionally, LOS is associated with long term mortality especially in elderly people.(8,27)

This study demonstrated a significant correlation between high mNUTRIC scores, worse clinical outcomes, and extended LOS, consistent with existing research. Studies from Purwakarta and other regions further validate the link between malnutrition and prolonged ICU stays.(18,21)

The findings are corroborated by prior research, which indicates a notable disparity in the duration of ICU stays between patients at high nutritional risk (approximately 8 days) and those at low nutritional risk (less than 5 days).(28,29) Reported that patients with high nutritional risk are more likely to require prolonged hospitalization and have an increased mortality rate in the ICU.(30) It is therefore recommended that patients with higher mNUTRIC scores should receive early nutritional intervention in order to reduce complications or mortality related to nutrition. (31)

There are two type of nutrition support for critical patients. The first is parenteral nutrition and the second is enteral nutrition.(32) Enteral nutrition which giving feeding through a tube placed into the stomachis first choice for critical patients and followed by parenteral nutrition which giving nutrition through a tube inserted into a vein. The parenteral route is more save even for elderly patients and can giving adequate nutrition.(33) However, enteral route can optimize nutrition feeding than parenteral especially for patients in severe condition.(32)

CONCLUSION

This study demonstrated that utilizing nutritional screening tools effectively identifies malnourished patients, with malnutrition shown to be associated with patient outcomes and length of stay (LOS).

An effective strategy to improve the nutritional status of ICU patients involves conducting a nutritional assessment within the first 24 hours after admission. Future experimental studies, particularly follow-up research, could focus on determining the optimal timing for initiating parenteral nutrition to enhance patient outcomes and reduce LOS.

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Ethical Approval

This study received ethical approval from the Health Research Ethics Committee of the Faculty of Medicine, University of Lampung, under decree number 352/UN26.18/PP.05.02.00/2024. Additionally, a research permit was granted by the Ethics Commission of Dr. H. Abdul Moeloek Hospital, Lampung Province, under decree number 051/KEPK-RSUDAM/XII/2023.

Conflicts of Interest

The authors declare no conflict of interest

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Author Contributions

Conceptualization, MJ, GDA; methodology, MJ, GDA; formal analysis, GDA; investigation, GDA; data curation, GDA; writing—original draft preparation, GDA, NS ; writing—review and editing, NS; visualization, NS; supervision, MJ; project administration, GDA; funding acquisition, MJ.

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