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Nutritional Risk Assessment in Intensive Care Unit Patients Using the mNUTRIC Score and its Association with Clinical Outcomes: A Prospective Observational Study

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A B S T R A C T

Introduction: Malnutrition in intensive care unit (ICU) patients is associated with adverse clinical outcomes. The modified nutrition risk score (mNUTRIC) in the critically ill patients has been proposed as an appropriate nutritional assessment tool. This study designed to evaluate the nutritional status of hospitalized patients in the intensive care by mNutric, and its relationship with the patient's condition and hospitalization outcomes.

Materials & Methods: : In this prospective observational study, the nutritional status of 90 critically hospitalized patients within a 40 week period was determined using the mNutric score tool. For calculation of this score, patient data including age, number of co-morbidities, number of hospitalization days, SOFA score, APACHE II score was extracted from patient medical documents. Patients with scores higher than 5 were considered as high nutritional risk and patients with ≤5 were low nutritional risk. Analysis was done at a significance level of 0.05.

Results: The mean age of participants was 60.72 ± 19.46 years. 60% of patients were male and 40% were female. The average hospitalization duration in the intensive care unit was 7.06 ± 6.36. The mean mNutric Score in the studied patients was 3.70 ± 2.23. Results showed 57 (63.3%) and 33 (36.7%) subjects were identified as at low and high nutritional risk, respectively, with different ventilator dependency, patient's mortality and age.

Conclusion: High percent of hospitalized patients (36.7%) in intensive care units were identified as nutritionally high risk subjects. In high risk patients compared to low ones, more ventilator dependancy, longer days of hospitalization and more deaths were seen.

Keywords: mNUTRIC, hospitalization, nutritional status, Intensive care, risk assessment

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Introduction

The nutritional status assessment of patients in intensive care units is one of the necessities for scientific and effective care during ICU staying times, also important for orienting decisions regarding the type of cares that will be required. One of the new, valid, and practical indexes that has introduced in scientific literature for assessing the nutritional status of patients admitted to intensive care units is the NUTRIC score (1, 2). Most patients admitted to such units develop some degree of malnutrition due to reasons such as food intolerance, inability to receive nutrition orally, restriction of intake by the treatment team to achieve certain medication goals, and other problems in feeding. Identifying these problems in the early stages can significantly effect the achievement of treatment goals and to prevent complications during treatment process (3, 4).

Based on the available data, now about 40% of critically ill patients are malnourished at the time of admission, and two-thirds of them become severly malnourished during their hospital stay (5). Also in other studies the prevalence of malnutrition in patients admitted to intensive care units has been reported to vary from 38 to 75 percent [4]. Malnutrition can increase the length of hospital stay and affect the progression of the primary disease, such that it should be prevented by using a proper diet (6). Disease-related malnutrition also has detrimental effects on the treatment process. This health problem leads to increased infections, delayed recovery, increased hospital costs, and mortality, especially in the elderly subjects and patients with malignant diseases such as cancer (3).

The Nutric score is an index that is currently used to assess the nutritional status of patients admitted to intensive care units. This index has designed and introduced in 2011 by Heyland to quantify the risk of adverse outcomes associated with inadequate nutrition in patients admitted to intensive care units (7). This scoring system includes six variables: age, Acute Physiology and Chronic Health Evaluation (APACHE II) score, length of stay in the ICU, number of comorbidities, Sequential Organ Failure Assessment (SOFA) score, and interleukin-6 (IL-6). Subsequent validation of the NUTRIC score, without considering IL-6, also has been shown for application in a different patient population. The higher the sum of the scores for these components, the greater likelihood of nutritional risk and after immediate diagnosis, patients will benefit from nutritional therapy intervention (8, 9). This practical tool is clinically useful in critical care because it uses variables that are routinely assessed in the intensive care unit (10).

Based on the scientific searches, it was revealed that no study has yet examined the nutritional status of hospitalized patients in the intensive care unit in Ilam by the NUTRIC score. Therefore, the present study was conducted with the aim of evaluating the nutritional status of patients admitted to the intensive care units based on the mNUTRIC score and its association with patient status and hospitalization outcomes at Shahid Mostafa Khomeini Hospital of Ilam.

Materials and methods

Study Design

This study was a prospective observational study. After obtaining the ethical approvement from the Research Deputy of Ilam University of Medical Sciences, it was conducted with the aim of evaluating the nutritional status of patients admitted to intensive care units based on the mNUTRIC score and its association with patient status and hospitalization outcomes.

Setting and Participants

The sample size in this study was 95 cases from patients that were admitted to the intensive care units of Shahid Mostafa Khomeini Hospital in Ilam. Five patients were excluded due to early discharge and hospitalization for less than 24 hours in the ICU, and

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the remaining 90 patients were entered in the study. Study was done during a 10-month period. Inclusion criteria was: being older than 18 years of age, being admitted to the intensive care unit, being hospitalized for more than 24 hours in the ICU, and filling the informed consent form by the patients or their companions. Exclusion criteria was: lack of necessary data for completing the questionnaire, hospitalization in the intensive care unit for less than 24 hours, unwillingness to continue participation, transfer from the current to another ward, re-admitted patients, patient death within less than 24 hours after admission, sudden brain death, pregnancy or lactating state.

Weight and other anthropometric measures related to the nutritional care of patients were checked and recorded at the time of patient admission. Additionally, the number of days with ventilator dependency, use or non-use of dialysis, and use of vasodilating drugs were extracted from the patient's medical records. Information regarding demographic characteristics was obtained from patient's medical document and the hospital's HIS.

Sample Size

The sample size in this study was 95 cases from patients that were admitted to the intensive care units of Shahid Mostafa Khomeini Hospital in Ilam. Five patients were excluded due to early discharge and hospitalization for less than 24 hours in the ICU, and the remaining 90 patients were entered in the study.

Measurements

Demographic Characteristics Checklist

Weight and other anthropometric measures related to the nutritional care of patients were checked and recorded at the time of patient admission. Additionally, the number of days with ventilator dependency, use or non-use of dialysis, and use of vasodilating drugs were extracted from the patient's medical records. Information regarding demographic characteristics was obtained from patient's medical document and the hospital's HIS.

Modified Nutrition Risk in the Critically Ill (mNUTRIC) Score

All patients' information related to the mNUTRIC score assessment and patient laboratory tests was recorded in prepared checklists and used later for more analyses and calculations. The mNUTRIC Score was used to assess the nutritional status of patients. The mNUTRIC score was calculated based on data including age, APACHE II score, SOFA score, number of comorbidities, number of days of hospitalization, and ICU stay. The mNUTRIC score ranged from 0 to 9 points. A total score less than 5 (<5) indicated low nutritional risk, while a score of 5 or higher (≥5) indicated high nutritional risk.

Based on the calculated mNUTRIC score, patients were placed in one of two groups: low or high risk of malnutrition. In patients who simultaneously used multiple routes of nutrition, the total daily energy intake was calculated from the sum of the different methods. The gap between energy intake and estimated energy requirements was also calculated.

Statistical and Data Analysis

All collected data were checked by the researchers for accuracy and the presence of outliers before entering the SPSS. After entering data, appropriate descriptive and inferential statistical tests at a significancy level of 0.05 were recruited. We used descriptive analysis based on types of data; Mean±SD for quantitative and number and percents for qualitative variables. Independent samplet- tests for comparing quantitative variables between low risk and high risk groups and chi squar test for qualitative variables between these two groups.

Results

Ninety patients with a mean age of 60.72 ± 19.46 years were participated, of whom 54 were male (60%) and 36 were female (40%). The mean length

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of stay in the intensive care unit was 7.06 ± 6.36 days (range: 1-30 days). The mean BMI in patients was 24.51 ± 4.47, with the lowest from 17.96 to the highest 42.19. The mean mNutric Score in the studied patients was 3.70 ± 2.23. Other demographic characteristics of subjects have shown in Table-1.

Table 1. Demographic Characteristics of the Patients.

Variable	Mean ± SD	Minimum	Maximum
Age (year)	60.72 ± 19.46	21	97
LOS (days)	7.06 ± 4.25	2	30
Wt (Kg)	73.64 ± 12.27	50	108
Ht (Cm)	173.71 ± 9.01	155	190
BMI	24.51 ± 4.47	17.96	42.19
mNutric Score	3.7 ± 2.23	0	9

SD: Standard Deviation ; LOS: Length of Stay ; Wt: Weight ; Ht: Height ; BMI: Body Mass Index ; mNutric Score: modified NUTRIC Score

43.3% of patients were connected to the ventilator. From the 90 studied patients, 54.4% were discharged and 44.4% were died. Table 2-4 shows the type of nutrition for patients admitted to the intensive care units, where 73 patients (82.2%) received oral feeding, 15 patients (16.7%) received enteral feeding, and 2 patients (2.2%) received a combination of feeding methods. None of the patients received intravenous nutrition. In the studied patients, sepsis and stroke accounted for the highest percentage of comorbidities. Based on the mNUTRIC score, from the 90 patients studied, 57 patients (63.3%) and 33 patients (36.7%) were identified as at low and high nutritional risk, respectively (Table 2).

The results showed a significant difference between patients with high and low nutritional risk in terms of ventilator dependency (76.5% vs. 23.5%). According to the results in Table 3-4, among 56 patients with low nutritional risk, 78.6% were discharged and 21.4% were died.

Table 2. Patient's distribution based on their clinical characteristics and nutritional risk status.

Variable	Subgroup	Frequency	Percent
Sex	Male	54	60%
	Female	36	40%
Ventilator dependency	Yes	39	43.3%
	No	51	56.7%
Discharging/Death state	Discharged	50	55.5%
	Died	40	44.4%
Feeding Rout	Oral	73	82.2%
	Enteral	15	16.7%
	Parentral	0	0%
	Mix	2	2.2%
mNutric score risk state	Low Risk	57	63.3%
	High Risk	33	36.7%

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In the high nutritional risk group, 17.6% of patients were discharged and 82.4% were died. Thus results showed that mortality rate was higher in patients with high nutritional risk compared to those with low nutritional risk. Based on the chi-square test, there was a significant association between patient discharge status and nutritional risk status (P = 0.000). However, no significant association was seen between patient gender and nutritional risk (P = 0.656); nevertheless, as shown in the table 3, male patients were more likely to be at nutritional risk than female patients, but this difference was not significant (Table 3).

Table 3. Comparing qualitative patients properties according to the level of nutritional risk in the population.

Variable		Nutrition Risk State		df	P-value
		Low Risk N (%)	High Risk N (%)		
Sex	Male	32(57.1)	22(64.7)	1	0.65
	Female	24(42.9)	12(35.3)		
Ventilator dependency	Yes	13(23.2)	26(76.5)	1	<0.001
	No	43(76.8)	8(23.5)		
Discharging/Death state	Discharged	44(78.6)	6(17.6)	1	<0.001
	Died	12(24.1)	28(82.4)		

Df: Degree of freedom, N: Numbers

The mean age in patients with low nutritional risk was lower than in patients with high nutritional risk (52.72 ± 18.00 vs. 74.21 ± 13.63), and this association was statistically significant (P = 0.000). Similarly, the mean length of hospital stay in patients with low nutritional risk was less than in patients with high nutritional risk (6.63 ± 6.30 vs. 7.79 ± 6.49), but this this difference was not statistically significant (P = 0.408). Regarding other variables such as BMI and weight, the independent sample t-test did not show any significant difference (P > 0.05)).

Table 4. Comparing the quantitative patients properties based on the nutritional risk status in the studied patients.

Variable	Nutrition Risk State		t	df	P-value
	Low Risk Mean ±SD	High Risk Mean ±SD			
Age (year)	52.71±18	74.21±13.63	6.34	81.49	<0.001
Wt (Kg)	74.04±12.26	72.97±12.45	0.394	87	0.69
BMI	24.41±4.57	24.68±4.38	0.278	87	0.78
LOS (days)	6.63±6.3	7.79±6.49	0.831	87	0.40

SD: Standard Deviation, Wt: Weight, BMI: Body mass index, LOS: Length of stay

Discussion

This study was a prospective observational study that conducted in the ICUs of one educational university hospital. The mean mNutric Score in the studied patients was 3.7. Patients with a score of 5 and above, who were identified as high risk nutritionally, had a longer duration of ventilator dependency, a higher percentage of mortality, a greater, significant severity of illness, and a longer but non-significant length of stay in the ICU. In the present study, 36.7% of the studied patient population in the intensive care unit was identified as high nutritionally at risk. Other

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studies that have used the mNutric Score criteria for assessing the nutritional risk among critically ill patients have reported different figures. In one study by Mahmoudpour et al., 13.9% of critically ill patients admitted to the ICU were identified with high nutritional risk (10), by applying the mNutric score tool in their study for nutritional risk assessment. In a study by Kalaiselvan et al., approximately 42.5% of patients were at high nutritional risk based on this index (11). Another study by Mendes et al. reported that 48.6% of their studied patients were at high nutritional risk (12). On average, previous studies have reported that the mean percent of patients with high nutritional risk or malnutrition is about 40% (10, 13).

Our findings are consistent with previous studies that have shown a high mNutric score in association with more ventilator dependency and longer ICU stays. They have shown that nutritional status of patients is a good predictor of outcomes in these patients, and generally, patients with good nutritional status have better hospitalization outcomes. In the current study, the percentage of deaths in patients with high nutritional risk was 82.4%, while the average percentage of deaths in the entire patient population was 44.4%, and in the low nutritional risk group it was 28.4%. In one study by Majari et al., the mortality rate in patients with high nutritional risk has reported about 80.7%. In that study, the average mortality rate in their entire study population has been 30.5%, and in the low nutritional risk group it has been 23.3% [13]. In study by Mahmoudpour et al., the mortality rate in patients with high nutritional risk has shown about 61.3%, while the average mortality rate in their entire study population has been 8.5%, and in the low nutritional risk there there has been no incidence of mortality to be reported (10). Both of the aforementioned studies similar with the current study have shown that the mortality rate in the population with higher nutritional risk based on the mNutric score is significantly higher. In both studies, the average age of the participants has been near to the current study. The mean age in the study by Majari et al. was 60 ± 19.2 years, and in the study by Mahmoudpour et al. it was 61.35 ± 10.88 years. Other studies with similar (13) or smaller (14) sample sizes than the current study have also reported a higher mortality rate in the group with higher nutritional risk based on the NUTRIC score.

In other studies, consistent with the current study, a longer duration of ventilator dependency and ICU stay has been reported in patients with higher nutritional risk. For example, in the Mahmoudpour et al. study (10), the mean duration of ventilator dependency in the high nutritional risk group was reported as 8.55 ± 5.35 days and in the low nutritional risk group as 2.36 ± 3.07 days. Simultaneously, other studies, including the study by Ishtiaq et al. (14) and one another by Tripathi et al. (15), a shorter duration of ventilator-free days in the high nutritional risk group have reported. Only one study (13) showed no significant difference between the high and low nutritional risk groups in terms of the duration of ventilator dependency. Among the abovementioned studies, some studies have been with higher sample size than this study (10, 11), and some of them have had a sample size equal to or lower than the current study (13, 14). Almost in all of the mentioned studies, the age range, mean age of populations, and the gender distribution is approximately similar with the current study.

Limitations and Strengths

One of the strengths of this study is its prospective design and assessment of patient's nutritional status with a new validated index in ICU patients of Ilam for the first time. Limitations of the study include the fact that the total number of ICUs in the educational and medical centers of Ilam was just these two ICUs, and due to the small changes and low patient turnover and concerns about prolonging the study period, it was not possible to increase the sample size or conduction of the study as a multicenter study.

Conclusion

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Finally, the results of this study showed that a high percentage of patients are at high nutritional risk, and this necessitates greater attention for the scientific implementation and follow-up of the patient's nutritional care plan. Consistent with a high percentage of previous studies, it was found that in the high nutritional risk group, there was a higher risk of mortality, worsening of the disease condition, increased duration of mechanical ventilation dependency, longer length of stay in the ICU and hospital, and increased medication costs. Furthermore, consistent with most previous studies, it was found that the mNutric score has good performance in predicting mortality rates and hospitalization outcomes in patients.

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CRediT authorship contribution statement

Conceptualization, Methodology, Validation: DV, HS, Formal Analysis, Investigation, Resources: HS, Software, Data Curation: HS, SS, AS, Writing–Original Draft Preparation, Writing–Review & Editing, Visualization, Supervision, Project Administration: DV.

Declaration of Generative AI and AI-assisted technologies in the writing process

The writers attest that they worked alone to write and prepare this text, without the use of any professional writing services. Only the writers' original work and contributions are reflected in the text.

Conflict of interest

There is no conflict of interest.

Ethical considerations

The present study was a MD student's thesis with this ethics code number: IR.Medilam.REC.1402.009, which was conducted on the ICU patient's population of Shahid Mostafa Khomeini Hospital in Ilam. All obtained information from patient documents has retained strictly confidential.

Data availability statement

Data will be available on formal request from the authors.

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