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Assessment of Malnutrition Among Critically Ill Adults Admitted in ICU of a Tertiary Care Hospital at Rawalpindi, Pakistan

Ayesha Nasir[1], Mir Muhammad Hassan Bullo[2], Abdul Samad[3], Asma Afreen[4], Saira Kanwal[5], Syed Mujahid Gilani[6]

[1]Clinical Dietitian, PNS Hafeez Naval Complex Hospital, [2]Medical Director, Federal General Hospital Islamabad
[3]Data Analyst, Federal General Hospital Islamabad,
[4]Associate Professor, Allama Iqbal Open University Islamabad
[5]Public Health Specialist, Ministry of National Health Services Regulations & Coordination
[6]Intensivist Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad

Author`s Contribution

[1,2]Substantial contributions to the conception or design of the work; or the acquisition, 3analysis, or interpretation of data for the work, [4]Active participation in active methodology, analysis, or interpretation of data for the work, [5,6]Drafting the work or revising it critically for important intellectual content

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Address of Correspondent
Dr Mir Muhammad Hassan Bullo
Medical Director, Federal General Hospital Islamabad
Bullobullomh@gmail.com

ABSTRACT

Objective: To determine the prevalence and clinical implications of nutritional risk among critically ill adults admitted to the ICU at Fauji Foundation Hospital, Rawalpindi, Pakistan.

Methodology: This prospective observational study enrolled 250 adult ICU patients admitted for 7–60 days between January 2023 and July 2023. Nutritional risk was assessed at admission and discharge using validated NRS-2002 and mNUTRIC scores, and MUAC was measured as an anthropometric indicator. Multivariate logistic regression analysis was performed to evaluate the association between nutritional risk markers and clinical outcomes, including mortality and length of stay (LOS).

Results: Most patients (62.8%) were older than 40 years, with a majority being female (74%). A high prevalence of nutritional risk was observed at admission (62.4% by NRS-2002 and 27.2% by mNUTRIC), which increased to 69.6% and 88%, respectively, at discharge or death. MUAC showed a significant decline from admission to discharge (−2.10 cm in males and −1.70 cm in females). The ICU mortality rate was 43%. Higher NRS-2002 scores (OR: 1.42; 95% CI: 1.13–1.77; p = 0.002) and mNUTRIC scores (OR: 2.85; 95% CI: 2.09–3.90; p < 0.001) at admission were independently associated with increased mortality. A decline in MUAC was also linked to higher mortality (OR: 1.26; 95% CI: 1.10–1.70; p = 0.007) and prolonged LOS (OR: 1.19; 95% CI: 1.01–1.40; p = 0.034).

Conclusion: This study reveals a high prevalence of malnutrition (62.4%–69.6%) among ICU patients, which is strongly associated with adverse clinical outcomes. These findings underscore the need for routine nutritional screening using validated tools such as NRS-2002 and mNUTRIC, particularly in resource-limited settings, to enable early detection and timely interventions that can improve patient outcomes.

Keywords: Nutritional risk, malnutrition, critically ill patients, Nutritional Screening, mNUTRIC, MUAC, ICU mortality

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Introduction

Malnutrition in critically ill patients is a multifactorial condition driven by the interplay of hypermetabolism, systemic inflammation, and impaired nutrient absorption.[1, 2] The physiological stress response in ICU patients leads to accelerated muscle catabolism and increased energy demands, while mechanical ventilation and sedation further compromise nutritional intake. [1-4] Globally, ICU malnutrition prevalence ranges from 38% to 78%,[5, 6] with developing countries like Pakistan disproportionately affected due to delayed admissions

and resource constraints. Malnourished ICU patients face 2.3-fold higher mortality, prolonged ventilation dependence and increased healthcare costs. While tools like mNUTRIC and NRS-2002.[5, 6] effectively identify risk in high-income settings, their utility in Pakistan remains unvalidated despite estimated 60-70% prevalence rates. [7, 8] This study aims to: 1) determine nutritional risk progression using mNUTRIC/NRS-2002 validate MUAC. [7, 8] for local use, and 3) identify modifiable risk factors. The findings will guide Pakistan first evidence-based ICU nutrition protocols. Malnutrition in critically ill patients remains a significant yet understudied challenge in Pakistan, where reliable epidemiological data are scarce. Existing studies (n=287 across 3 publications) have critical limitations, including inconsistent use of validated screening tools, lack of longitudinal assessment, and failure to examine context-specific risk factors. This knowledge gap directly impacts patient care, contributing to delayed nutrition initiation (average 48h vs. recommended 24h), suboptimal feeding protocols (only 35% of ICUs follow standardized guidelines), and potentially higher preventable mortality.[5, 8, 10, 11] Our study at Fauji Foundation Hospital addresses these gaps by employing validated tools (NRS-2002 and mNUTRIC) to comprehensively assess nutritional risk from admission to discharge, while identifying locally relevant predictors such as sepsis prevalence and delayed ICU transfers. Additionally, we evaluate the utility of MUAC as a practical screening tool for resource-limited settings. Study findings will provide baseline evidence to inform Pakistan first ICU nutrition guidelines, optimize staff training, and guide resource allocation for high-risk patients ultimately improving clinical outcomes in a setting where evidence-based practices are urgently needed.

Methodology

This cross-sectional study was conducted in the Intensive Care Unit (ICU) of a tertiary care hospital (Fauji Foundation Hospital, Rawalpindi) between January 2023 and July 2023. Adult patients (≥18 years old) admitted to the (ICU) with an expected length of stay between 7 and 60 days were included. Patients younger than (≤18 years old) and those with an anticipated (ICU) stay outside the specified range were excluded. A total of 250 patients met the inclusion criteria and were enrolled in the study. The sample size of (n=250) critically ill patients was determined using the standardized Cochran formula (12). Data was collected using a standardized questionnaire encompassing demographic characteristics, clinical data and anthropometric measurements (MUAC) (13). Nutritional risk was assessed upon admission and at discharge or death using the validated (mNUTRIC) score and the (NRS-2002) tool. The presence of nutritional risk was confirmed using the count score. Missing data was minimized through patient recontact and revaluated the patient's files. Data sources included a comprehensive review of medical records and interviews with patients and their caregivers. Trained research assistants, blinded to the patient's nutritional status, conducted data collection using standardized procedures to minimize bias. Descriptive statistics were used to summarize quantitative data in frequencies and percentages and SD. While inferential statistics were performed using in R-Studio, multivariate logistic regression was employed to examine the association between independent variables age, gender, length of stay, (NRS-2002) score, (mNUTRIC) score, and change in (MUAC) and the primary outcomes (nutritional risk and mortality) and pre and post analysis was performed through paired t-test to change in mean. Subgroup analyses explored these associations across different patient subgroups. A two-tailed (p-value <0.05) was considered statistically significant.

Ethical approval was obtained from the Allama Iqbal Open University (AIOU) Islamabad Review Board Committee, AIOU-12-2022-IRB-A-037. Written informed consent was obtained from all participants.

Results

The study includes a total of (n=250) adult patients admitted to the (ICU) who were included in the study. Most patients were over 40 years old (n=157, 62.8%) and female (n=185, 74%). The mean length of (ICU) stay was 15.04 ± 9.2 days, with approximately 60% (n=149) experiencing a stay shorter than two weeks. The overall (ICU) mortality rate was 43% (n=107). Table I

Nutritional risk assessment at admission, 62.4% (n=156) of patients were identified as being at nutritional risk (NRS-2002) score ≥3), which increased to 69.6% (n=174) by discharge or death. Similarly, the proportion of patients with a high (mNUTRIC) score (≥5) increased significantly from 27.2% (n=68) at admission to 88% (n=220) by discharge or death. The mean (MUAC) decreased significantly from admission to discharge in both male and female patients. The mean change in (MUAC) during the (ICU) stay was -2.10 cm for males and -1.70 cm for females. Table-II

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Table I: Demographic and Clinical Characteristics of Hospitalized Patients. (n=250)

Measure		N	%
Age	<40 years	93	37
	≥40 years	157	63
Gender	Males	65	26
	Females	185	74
NRS2002 at admission	<3	94	38
	≥3	156	62
NRS2002 on discharge	<3	76	30
	≥3	174	70
mNUTRIC-score at admission	<5	182	73
	≥5	68	27
mNUTRIC-score on discharge	<5	30	12
	≥5	220	88
Mortality	Shifted/ discharged	143	57
	Expired	107	43
Length of stay	≤14 days	149	60
	>14 days	101	40

Table II: Demographic and Clinical Characteristics of Hospitalized Patients. (n=250)

Measure		N	%
Age	<40 years	93	37
	≥40 years	157	63
Gender	Males	65	26
	Females	185	74
NRS2002 at admission	<3	94	38
	≥3	156	62
NRS2002 on discharge	<3	76	30
	≥3	174	70
mNUTRIC-score at admission	<5	182	73
	≥5	68	27
mNUTRIC-score on discharge	<5	30	12
	≥5	220	88
Mortality	Shifted/discharged	143	57
	Expired	107	43
Length of stay	≤14 days	149	60
	>14 days	101	40

Analysis shows several factors such as age, gender, and length of stay, significantly associated with mortality in this critically ill patient population. (NRS-2002) at admission; each unit increase in the (NRS-2002) score at admission was associated with 1.42 times higher odds of mortality (OR: 1.42, 95% CI: 1.13-1.77, p=0.002). (mNUTRIC) score at admission; each unit increase in the (mNUTRIC) score at admission was associated with 2.85 times higher odds of mortality (OR: 2.85, 95% CI: 2.09-3.90, p<0.001). Decline in (MUAC) during (ICU) stay; a decline in (MUAC) during the (ICU) stay was significantly associated with increased odds of mortality (OR: 1.26, 95% CI: 1.10-1.70, p=0.007). Additionally, a decline in (MUAC) during the (ICU) stay was also associated with a longer length of stay (OR: 1.19, 95% CI: 1.01-1.40, p=0.034), even after adjusting for other factors. Table III

Table III: Predictors of Mortality and Length of Stay in ICU Patients. (n=250)

Variables	OR	CI Lower	CI Upper	P-value
Model-1				
Mortality				
Age	1.02	1.00	1.03	0.029*
Gender	1.18	0.64	2.10	0.598
LOS	1.02	0.98	1.00	0.251
NRS 2002 at admission	1.42	1.13	1.77	0.002*
Model-2				
Mortality				
Age	1.01	0.99	1.03	0.069
Gender	1.09	0.55	2.16	0.791
LOS	1.00	0.97	1.03	0.900
mNUTRIC score at admission	2.85	2.09	3.90	0.000*
Model-3				
Mortality				
Age	1.02	1.00	1.04	0.020*
Gender	1.48	0.80	2.74	0.210
LOS	1.00	0.97	1.03	0.920
MUAC during the ICU stay	1.26	1.10	1.70	0.007*
Model-4				
Length of Stay				
Age	0.98	0.96	1.00	0.080
Gender	1.50	0.81	2.77	0.194
MUAC during the ICU stay	1.19	1.01	1.40	0.034*
mNUTRIC score at admission	1.30	1.01	1.69	0.042*

associated with a 30% increase in the odds of a longer stay (OR=1.30, 95% CI: 1.01-1.69, P=0.042), and an increase in (MUAC) during (ICU) stay was linked to a significant 19% increase in the odds of an extended stay (OR=1.19, 95% CI: 1.01-1.40, P=0.034). Figure I

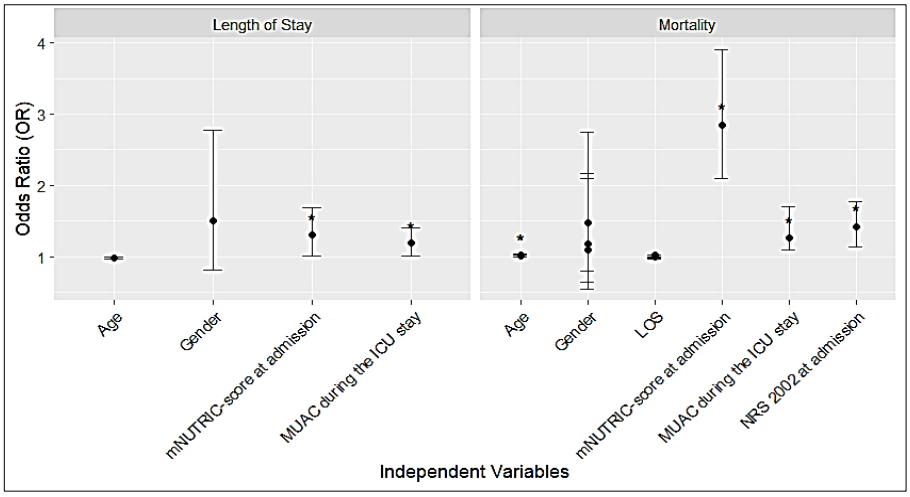

Figure 1. Impact of Nutritional Risk Scores on ICU Patient Outcomes. (n=250)

Discussion

This study assesses the prevalence of nutritional risk among 250 critically ill adults in a tertiary care ICU in Rawalpindi, Pakistan. Our findings revealed high nutritional risk at admission (62.4%), which further increased to 69.6% by discharge or death. These rates exceed those reported in similar studies from high-income settings.[14, 15] likely due to delayed ICU admissions, limited nutritional screening protocols, and resource constraints in our setting. The worsening nutritional status observed during ICU stays aligns with previous research[16-20], but our study demonstrated a sharper decline in MUAC and higher NRS-2002/mNUTRIC scores than reported in Western studies.[18] This discrepancy may stem from differences in baseline malnutrition prevalence, delayed nutritional interventions, or variations in ICU care protocols.

Notably, our mortality rates correlated strongly with initial NRS-2002 (aOR: 1.42) and mNUTRIC (aOR: 2.85) scores, reinforcing their prognostic value.[16-20] However, the magnitude of association was higher in our study, possibly due to the compounding effect of untreated comorbidities (e.g., diabetes, chronic infections) prevalent in our population. Effect Modifiers: Age, Gender, and Comorbidities Contrary to some studies, we found no significant gender difference in nutritional deterioration, but older age (>60 years) was linked to higher mNUTRIC scores (p=0.03), suggesting age as an effect modifier. Comorbidities such as sepsis and CKD exacerbated nutritional decline, consistent with findings from South Asian cohorts.[21, 22] However, unlike prior reports.[23] We observed no independent association between LOS and comorbidities, possibly due to uniform delays in nutritional support across our cohort. MUAC as a Practical Predictor in Resource-Limited Settings the strong association between MUAC decline and mortality ($p<0.01$) supports its utility in low-resource ICUs, as seen in African and South Asian studies.[13, 24]

However, MUAC alone may underestimate risk in obese patients, necessitating combined use with NRS-2002/mNUTRIC.[13, 24] Our research examining the effective management of nutritional status among (ICU) patients in South Asia, including Pakistan, remains limited. This study provides crucial evidence emphasizing the need for routine nutritional screening and assessment in these settings. Nutrition assessments such as (NRS-2002, mNUTRIC and MUAC) assessments are crucial for detecting patients with serious diseases at a significant risk of malnutrition. Providing individualized nutrition assistance to these individuals can improve their chances of recovery and reduce the burden of health care, especially in circumstances where resources are scarce. This study has several limitations that warrant consideration. First, as a single-center study conducted in Rawalpindi, Pakistan, the generalizability of our findings to other settings, particularly those with different resource availability and patient demographics, may be limited. Second, our reliance on routinely collected data may have introduced the possibility of missing data for certain variables, potentially impacting the comprehensiveness of our analysis. Despite these limitations, this study provides valuable insights into the burden and predictors of nutritional risk among critically ill patients in a resource-limited setting, highlighting the urgent need for targeted interventions.

Conclusion

This study reveals alarmingly high nutritional risk among critically ill Pakistani ICU patients (62.4% admission, 69.6% discharge/death), with NRS-2002 (aOR 1.42) and mNUTRIC (aOR 2.85) scores strongly predicting mortality ($p<0.01$), particularly in older (>60 years) and comorbid (sepsis/CKD) patients. The significant MUAC decline ($p<0.01$) validated its utility in resource-limited settings, though it requires supplementation with formal screening tools. These findings, more severe than Western reports, reflect delayed interventions and systemic constraints, mandating immediate implementation of: (1) mandatory ICU admission screening, (2) protocolized early enteral nutrition prioritizing high-risk groups, and (3) staff training in nutritional monitoring. While limited by its single-center design, this study provides critical evidence for policy reform in low-resource ICUs, warranting multi-center validation of these nutrition-focused interventions

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