

# Association of malnutrition on admission with hospital stay and clinical outcome in critically ill elderly patients

*Associação da desnutrição na admissão com o tempo de internação hospitalar e desfecho clínico em idosos críticos*

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## ABSTRACT

**Introduction:** Malnutrition is one of the most prevalent nutritional disorders in medical institutions. The presence of depleted nutritional status at the time of admission has been demonstrated to have a deleterious effect on patient prognosis, resulting in an increase in the duration of hospital stay. The objective of this study was to evaluate the prevalence of hospital malnutrition upon admission and its relationship with clinical outcomes in critically ill elderly patients. **Methods:** This was a cohort study, with data being collected from the medical records of elderly patients who were hospitalized in the critical units of the University Hospital of Lagarto, SE, Brazil. Clinical and nutritional data were collected at the time of admission. The NRS-2002, body mass index (BMI), calf circumference (CC), length of hospital stays, and clinical outcome data were collected. The statistical analysis was performed using IBM® SPSS® v.20.0 software. **Results:** A total of 268 medical records of critically ill elderly patients were evaluated, of which 51.1% were female. The median age was 76.5 (69–84) years. Regarding nutritional parameters, 86.9% of the sample was at nutritional risk according to the NRS-2002, 82.1% showed reduced muscle mass based on calf circumference (CC) assessment, and 44.8% were classified as underweight based on BMI. A difference in the median length of hospital stay was identified according to NRS-2002 classification, with longer stays among those at nutritional risk ( $p=0.036$ ). A statistically significant association was observed between BMI, NRS-2002, CC classifications, and mortality ( $p<0.001$ ). **Conclusion:** There is an association between nutritional risk, reduced CC, and malnutrition based on BMI with longer hospital stays and worse clinical outcomes in critically ill elderly patients.

## RESUMO

**Introdução:** A desnutrição é uma das desordens nutricionais mais prevalentes no âmbito hospitalar. O estado nutricional depletado no momento da admissão demonstra um efeito prejudicial no prognóstico do paciente, resultando em um aumento na duração da internação hospitalar. Dessa forma, o objetivo desse estudo foi avaliar a prevalência da desnutrição hospitalar no momento da admissão e sua relação com desfecho clínico em pacientes idosos críticos. **Método:** Este foi um estudo de coorte, com coleta de dados nos prontuários de idosos hospitalizados nos setores críticos do Hospital Universitário de Lagarto, SE, Brasil. Os dados clínicos e nutricionais foram coletados no momento da admissão do paciente. Foram coletados dados de NRS-2002, índice de massa corporal (IMC), circunferência da panturrilha (CP), tempo de internamento hospitalar e desfecho clínico. A análise estatística foi realizada pelo software IBM® SPSS® v.20.0. **Resultados:** Foram avaliados 268 prontuários de idosos críticos, dos quais 51,1% eram do sexo feminino. Observou-se uma mediana de idade de 76,5 (69-84) anos. Em relação aos parâmetros nutricionais, 86,9% da amostra apresentou risco nutricional a partir do NRS-2002, 82,1% apresentou redução da massa muscular pela avaliação da CP e 44,8% apresentou baixo peso pela classificação do IMC. Foi possível identificar diferença na mediana de dias de internação em relação a classificação do NRS-2002, com maior tempo para aqueles que estavam em risco nutricional ( $p=0,036$ ). Uma associação estatisticamente significativa foi observada entre as classificações do IMC, NRS-2002 e CP com o óbito ( $p<0,001$ ). **Conclusão:** Existe associação entre o risco nutricional, redução da CP e desnutrição pelo IMC com tempo de internamento e piores desfechos clínicos em pacientes idosos críticos.

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## INTRODUCTION

Malnutrition is one of the most prevalent nutritional disorders in hospitals. In Latin American countries, malnutrition affects 20 to 50% of hospitalized adults. At the time of admission, this scenario can go up 40 to 60% and is even more prevalent among the elderly<sup>1</sup>.

Depleted nutritional status at the time of admission can be an even more aggravating factor in prognosis, causing higher economic impact, slowing down healing, and increasing the length of hospitalization, risk of infection, and mortality<sup>1,2</sup>. A prospective cohort study of 417 patients found that during 30 days of observation, those who were malnourished had a hospital stay twice as long as those who were well-nourished<sup>2</sup>.

It is noteworthy that some diseases are an independent risk factor for malnutrition due to their high catabolism, such as cancer, heart failure and cirrhosis, which substantially compromise hospital stays<sup>3</sup>. Therefore, early identification of nutritional status is essential for a more efficient nutritional strategy during hospitalization and, consequently, a shorter hospital stay. Nutritional screening tools, such as the Nutritional Risk Screening (NRS-2002) and the Nutric Score, helps with diagnosing this condition earlier<sup>4</sup>.

As it is a multifactorial condition, inadequate food consumption is one of the main causes of malnutrition and is often related to the disease. In addition, lack of appetite and difficulty in eating, especially in the elderly, is a common condition even before hospitalization<sup>5</sup>.

Early identification of malnutrition can support new nutritional strategies aimed at recovering nutritional status earlier during hospitalization, as well as reducing the rate of re-hospitalization of the elderly. The aim of this study was therefore to assess the prevalence of malnutrition at the time of hospital admission and its relationship with length of stay and clinical outcome in critically ill elderly patients.

## METHODS

### Study design and sample

This is a cohort study conducted between January and June 2024, collecting data from the medical records of patients in the yellow and red wards of the Lagarto University Hospital (HUL) in the municipality of Lagarto, south-central Sergipe, Brazil. HUL serves the healthcare needs of the population of Lagarto and the surrounding region. The red ward is for patients in critical condition or requiring immediate care, while the yellow ward handles urgent cases requiring priority care but with a waiting time.

Inclusion criteria consisted of medical records of patients aged 60 years or older, admitted to the critical care unit during the first half of 2024. Medical records that lacked complete initial nutritional assessment data necessary for this research were excluded.

### Variables and data collection

The following information was collected from the medical records following the evolution carried out by the HUL nutritionists: sociodemographic data (gender and age), health data (comorbidities, length of stay and outcome), route of feeding (oral, enteral, parenteral or mixed), nutritional status (nutritional screening classification) and anthropometric data, using a questionnaire prepared by the author himself to compile the information. The clinical outcomes considered were hospital discharge, transfer, and death.

For the nutritional screening, information was collected from the NRS-2002 tool, which is applied at HUL within 72 hours of hospital admission. The tool classifies patients at nutritional risk when they accumulate  $\geq 3$  points and at no risk when they have  $< 3$  points<sup>6</sup>. Anthropometric data such as calf circumference (CC), weight, height, and body mass index (BMI) were recorded. CC was classified according to the cut-off point proposed by Barbosa-Silva et al.<sup>7</sup>, body mass index (BMI) classification was also considered, according to the guidelines of PAHO/SABE<sup>8</sup>: underweight ( $< 23 \text{ kg/m}^2$ ), normal weight ( $23\text{--}27.9 \text{ kg/m}^2$ ), overweight ( $28\text{--}29.9 \text{ kg/m}^2$ ), and obesity ( $\geq 30 \text{ kg/m}^2$ ). Elderly with a BMI  $< 23 \text{ kg/m}^2$  were considered malnourished.

### Ethical aspects

This study was submitted to and approved by the Research Ethics Committee of the Federal University of Sergipe, under No. 7.090.894, in accordance with Resolution No. 466 of the Ministry of Health.

### Statistical analysis

Statistical analysis was carried out using IBM® SPSS® v.20.0 software. A descriptive analysis of the variables was carried out using measures of central tendency, dispersion, absolute and relative frequencies. The Kolmogorov-Smirnov test was applied to identify the normal distribution of the variables. The Mann-Whitney test was used to assess the length of hospital stay according to the nutritional indicator classifications. Pearson's chi-squared test was used to verify the association between nutritional indicators and length of hospital stay. For these tests, a significance level of  $p < 0.05$  was adopted.

## RESULTS

Of the 359 patient records eligible for the study, 91 records that did not meet the inclusion criteria were excluded, resulting in a final sample of 268 critically ill elderly patients.

This sample had a median age of 76.5 (69-84) years, of which 51.1% were female. The main causes of hospitalization were cardiovascular disorders (28.7%), respiratory disorders (26.5%) and gastrointestinal tract disorders (9%). Oral feeding was more common (61.9%) than alternative dietary routes. With regard to nutritional parameters, 86.9% of the sample was found to be at nutritional risk based on the NRS-2002,

82.1% had reduced muscle mass (MM) based on the CP assessment and 44.8% were underweight according to the BMI classification (Table 1).

It was possible to identify a difference in the median number of days of hospitalization in relation to the NRS-2002 classification, with a longer time for those at nutritional risk ( $p=0.036$ ). There was a statistically significant association between the BMI, NRS-2002 and VC classifications and the clinical outcome, so that 46.7% of underweight patients, 37.8% of those at nutritional risk and 36.8% with reduced VC died ( $p<0.001$ ) (Table 2).

**Table 1** – Sociodemographic, health, and nutritional characteristics of critically older patients.

Variables	Sample	Variables	Sample
<b>Age median (IQR)</b>	76.5 (69-84)	<b>CP classification - n (%)</b>	
<b>Sex - n (%)</b>		Low muscle reserve	220 (82.1)
Male	131 (48.9)	Adequate	48 (17.9)
Female	137 (51.1)	<b>Feeding route - n (%)</b>	
<b>Age group - n (%)</b>		Oral	166 (61.9)
60-69 years	70 (26.1)	Enteral	102 (38.1)
70-79 years	92 (34.3)	<b>Clinical diagnosis - n (%)</b>	
≥ 80 years old	106 (39.6)	Respiratory	71 (26.5)
<b>BMI classification - n (%)</b>		Cardiovascular	77 (28.7)
Low weight	120 (44.8)	Git	24 (9.0)
Adequate	93 (34.7)	Infection	22 (8.2)
Overweight	55 (20.5)	Renal	20 (7.5)
<b>NRS-2002 classification - n (%)</b>		Endocrine	12 (4.5)
Nutritional risk	233 (86.9)	Neoplasm	10 (3.7)
Adequate	35 (13.1)	Other	32 (11.9)

n = sample size; IQR = interquartile range; GIT = gastrointestinal tract; BMI = body mass index; NRS = nutritional risk screening.

**Table 2** – Association between length of hospital stay, clinical outcome and nutritional markers in critically ill hospitalized elderly patients.

Variables	Length of stay	p	Outcome		p
			Hospital discharge	Death	
	Median (IQR)		n (%)	n (%)	
<b>Sample</b>	15.0 (9.0-25.8)	-	179 (66.8)	89 (33.2)	-
<b>BMI classification</b>					
Low weight	16.5 (10-26.5)	0.538	64 (53.3)	56 (46.7)	<0.001
Adequate/overweight	14.0 (9-25.8)		115 (77.7)	33 (22.3)	
<b>NRS-2002 classification</b>					
Nutritional risk	16.0 (9.5-27.0)	0.036	145 (62.2)	88 (37.8)	<0.001
Adequate	12.0 (7.0-20.0)		34 (97.1)	1 (2.9)	
<b>CP classification</b>					
Reduced MM	15.0 (9.0-25.0)	0.729	139 (63.2)	81 (36.8)	0.007
Adequate	15.5 (9.0-29.0)		40 (83.3)	8 (16.7)	

n = sample size; CC = calf circumference; IQR = interquartile range; BMI = body mass index; NRS = nutritional risk screening, MM = muscle mass.

## DISCUSSION

In this study, most of the elderly in the critical sectors were at nutritional risk as soon as they were admitted to hospital, and almost half were already malnourished according to the BMI classification. Low muscle reserve could also be seen on admission, using the CC classification as an indicator.

Assessing body composition is important for nutritional management and, in the setting of critical hospitalization, simple, low-cost bedside tools are important. CC has a high correlation with more advanced methods of assessing BM and is widely used in the elderly population<sup>9</sup>.

A cross-sectional study carried out in an ICU by Athayde et al.<sup>10</sup> found a 61.3% reduction in MM evaluated by CC. In the present study, this figure was higher (82.1%). This data at hospital admission allows us to predict a worsening of the clinical condition during hospitalization, since MM tends to reduce gradually during hospitalization, especially in the elderly<sup>11</sup>.

Bakkaloglu et al.<sup>12</sup> found that, in a sample of 5,999 hospitalized patients, 49.8% were at nutritional risk according to the NRS-2002 during hospital admission, and that this variable was associated with in-hospital mortality. This result corroborates those found in the present study, in which more than half of the critically ill elderly individuals were at nutritional risk, and this finding was associated with longer hospital stays and death in this population.

On the other hand, 20.5% of the patients admitted to the critical care unit were overweight, similarly to what was described by Athayde et al.<sup>10</sup> (29.7%). Excess weight can underdiagnose malnutrition in these patients, and the lack of more effective tools for predicting MM increases this risk and directly influences nutritional therapy<sup>13</sup>.

In this context, this study is the first to evaluate nutritional parameters on patient admission to HUL, which shows that identifying patients at nutritional risk, leading to an early therapeutic approach, is a key factor for appropriate nutritional care plans. In addition, there are few studies in the literature that have evaluated nutritional risk and CC as markers of poorer nutritional status on hospital admission and their relationship with length of stay among critically ill elderly patients.

The results of this study need to be evaluated with caution, since it involves information collected from medical records which may have restricted important information. Furthermore, this form of data acquisition is susceptible to the skill of the evaluator of the anthropometric assessment. In addition, the use of different nutritional parameters, such as nutritional screening, total body mass, and MM, can influence the results, making it difficult to make an accurate diagnosis, especially among the elderly.

## CONCLUSION

Since malnutrition is the most aggravating nutritional risk factor in hospital settings, this study demonstrated an association between nutritional risk, reduced CC, and malnutrition based on BMI. There is a longer hospital stay and a higher incidence of death among critically ill elderly patients. This highlights the need for early identification of malnutrition in the elderly to improve nutritional interventions and prevent worse clinical outcomes.

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**Conflict of interest:** The authors declare there are none.