Quality Indicators in Enteral Nutrition Therapy: Application among Older Patients in an Intensive Care Unit

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Abstract

Objective: to investigate the quality indicators in enteral nutritional therapy in older patients admitted to the intensive care unit of a university hospital in the city of João Pessoa, Paraíba. *Methods*: a retrospective, cross-sectional study was carried out with older adults admitted to the intensive care unit between March 2018 and March 2019. The indicators used were the frequency of measurement of Body Mass Index (BMI) at admission; estimated energy expenditure and protein requirement; adequate administration of prescribed vs. infused volume; patients fasting before starting enteral nutritional therapy; diarrhea and constipation according to the parameters of the International Life Sciences Institute of Brazil. For the comparison between quality indicators and clinical outcomes (hospital discharge and death) and length of stay (≤14 and >14 days), the chi-square test was used, with associations with $p<0.05$ being considered significant. *Results*: there were 79 older adults, with an average hospital stay of 14 days. Regarding the indicators, the frequency of BMI measurement at admission and the estimate of energy expenditure and protein requirement reached the targets. When analyzing the association of quality indicators with clinical outcomes, significant differences ($p=0.010$) were observed between the infused vs. prescribed volume indicator and hospital discharge. *Conclusion*: the indicator of the frequency of adequate administration of prescribed vs. infused volume had a significant association with the outcome, suggesting that this indicator should be considered in monitoring nutritional assistance for older adults. It is therefore necessary to develop action plans to ensure the effectiveness of the processes, although more studies are also needed.

Keywords: Health of the Elderly. Nutrition Therapy. Intensive Care Units. Quality Indicators, Health Care.

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INTRODUCTION

The rapid growth of population aging, and the physiological changes resulting from the process, leave older adults prone to deficits and the increased possibility of hospitalization, as well as vulnerable to nutritional problems. The importance of nutrition in the hospital environment should therefore not be underestimated, especially in the intensive care unit (ICU)[1].

According to Pedrosa et al.[2], when older adults are admitted to the ICU, factors other than age – such as functional status prior to admission, the presence of associated comorbidities, the severity of the disease which led to ICU admission and hemodynamic disorders – can encourage more invasive procedures, which prolong stays in the ICU, leading to more complications and greater exposure to mortality among this group.

In 2013, a review assessed the malnutrition rate of hospitalized older adults in Brazil, finding a similar prevalence to that of the overall population, with 60% of older adults in Brazilian hospitals identified as malnourished[3] .

The nutritional status of an inpatient has a major influence on their clinical evolution, and can directly affect prognosis. Studies indicate that 35% to 65% of hospitalized older adults have some degree of malnutrition, a finding which may be related to a high rate of infectious complications and a considerable increase in mortality[4].

Given this scenario, it is extremely important to provide older patients with effective nutritional therapy (NT), as inadequate nutrition contributes to the worsening of many illnesses, particularly in cases of acute disease[5]. It is noteworthy that in this age group, nutritional problems are generalized, and the catabolic effects of disease quickly result in a state of malnutrition among older adults, which is directly related to worsening prognoses, such as: increased infection rates; a higher incidence of pressure injuries; increased hospital stays; slower convalescence following acute illness; and increased mortality[5].

NT has a significant impact on the clinical evolution of a hospitalized patient, especially in anorexic ICU patients who are unable to eat orally for days or months, for whom enteral nutritional therapy (ENT) and/or parenteral nutritional therapy (PNT) is indicated[6].

ENT may be indicated in the following situations: patients who are unable to achieve adequate oral intake, to meet their daily nutritional needs, either because of diseases of the upper gastrointestinal tract, orotracheal intubation, or neurological disorders, with an impaired level of consciousness or masticatory movement. It is also indicated in cases where the patient does not reach full oral intake (between 60 and 70%), due to anorexia and/or various etiologies[6].

Patients in intensive care often present inadequacies in nutritional support, either due to under or overestimation of their daily nutritional needs, the delayed introduction of ENT, interruptions to procedures, or because of complications arising from the state of the disease and/or reasons related to nutritional therapy[7], including diarrhea, constipation, prolonged use of mechanical ventilation, and infections[8].

To evaluate and monitor NT, identifying the possible difficulties and failures of the nutritional care protocols provided to the patient, it is important to apply quality indicators in nutritional therapy (QINTs), with the aim of improving nutritional care[9].

QINTs, which are highly applicable in the ICU, include nutritional screening frequency, frequency of diarrhea and constipation, frequency of obstruction of the nasoenteral tube (NET), frequency of early initiation of nutritional therapy, frequency of fasting for more than 24 hours in patients undergoing ENT, frequency of non-compliance of the prescription of nutritional therapy, frequency of estimation of energy and protein needs, and frequency of discrepancy between the prescribed and the provided supply of ENT, among others, and have emerged as a powerful tool to combat the adverse effects that contribute to increased hospital malnutrition and increased morbidity and mortality, and also to reducing the cost-benefit of nutritional therapy. QINTs, a tool used by the nutritional therapy multidisciplinary

team (NTMT), can indicate possible failures in the execution of tasks related to EN, allowing decisions to be taken to improve the service in case of fluctuations in quality[10].

Seeking to contribute to the nutritional care of the critically ill and, consequently, to achieve better clinical outcomes and reduce hospital spending, the present study aimed to investigate the quality indicators in enteral nutritional therapy in older adults hospitalized in an intensive care unit of a public hospital in the city of João Pessoa, Paraíba, Brazil.

METHOD

A cross-sectional, retrospective study was conducted, using data from the medical records of older patients admitted to the intensive care unit of the Lauro Wanderley University Hospital in the city of João Pessoa, Paraíba, Brazil.

The study sample was non-probabilistic, obtained for convenience, and included all older adults hospitalized between March 2018 and March 2019. The inclusion criteria were as follows: hospitalized in the ICU for more than 72 hours, received ENT exclusively and with the nutritional monitoring form adopted by the nutrition service included in the patient's medical records. During this period, 318 older adults were admitted, of whom 25 died and 90 were discharged within 72 hours. Patients discharged in this period were excluded from the sample, as this is the timeframe required to detect nutritional risk, apply quality indicators and obtain the results of nutritional therapy, and is therefore applied as the cutoff point for completing the nutritional monitoring form for critical patients adopted in the protocols of the institution studied. A total of 80 patients receiving oral, parenteral, or mixed nutritional therapy or who did not begin a diet, and 44 patients whose medical records did not include the nutritional monitoring form, were excluded. The sample therefore consisted of 79 older adults.

The nutritional monitoring form used in the daily routine of the nutritionists was created by such professionals to monitor the nutritional therapy of patients admitted to the ICU of the hospital. It includes general data related to patient identification, clinical history, anthropometry, biochemistry, signs of perfusion and clinical signs, and also identifies certain important nutritional parameters. Of these data, to meet the objectives of the study, only the following parameters were analyzed: age; gender; period of hospitalization; clinical outcome and variables for calculating quality indicators in nutritional therapy (QINT), of which the following six were chosen: frequency of measurement of body mass index (BMI) at admission; frequency of measurement or estimate of energy expenditure (EE) and protein requirements; frequency of proper administration of prescribed x infused volume in patients undergoing nutritional therapy; frequency of patients fasting before enteral nutritional therapy (early NT); frequency of diarrhea; frequency of episodes of intestinal constipation.

Chart 1 shows the indicators with their respective formulas and targets recommended by the International Life Sciences Institute (ILSI) of Brazil[11], which were chosen for this study due to the possibility of applying the data available in the medical records.

The data were analyzed using descriptive and analytical statistics. In analytical statistics, the normality of the data was first assessed using the Kolmogorov-Smirnov test. In the analysis and presentation of the results, in addition to absolute and relative frequencies, mean and standard deviation (SD) were used for variables with normal and median distribution, and interquartile range (IQ) was used for those with non-normal distribution. For comparison between the quality indicators, days of hospitalization (≤14 days or >14 days, which was the average obtained), and outcome (discharge or death), the chi-square test was used. When conditions for using the chi-square test were not verified, Fisher's exact test or Yates' correction were used. The results were considered statistically significant with a value of $p<0.05$.

In performing the study the ethical aspects that regulate research in human beings were considered, in accordance with Resolution 466/12 of the National Health Council of the Ministry of Health (or CNS/MS)[12]. As this is a retrospective, non-interventionist study, the waiver of the Informed Consent Term (ICF) was requested ad approved by the Ethics and Research Committee under opinion No. 3,449,341 of *Plataforma Brasil*.

Chart 1. Quality indicators, formulas for estimation and targets proposed by International Life Sciences Institute.

- Frequency of BMI measurement at admission in patients undergoing ENT: *Number of patients undergoing ENT with BMI measured at admission* x 100 Total number of patients undergoing ENT TARGET: >80%
- Frequency of measurement or estimate of energy expenditure and protein requirement in patients undergoing ENT: *No. of patients undergoing ENT with assessment of energy and protein expenditure* x 100 *Total number of patients undergoing ENT* TARGET = ≥ 80%
- Frequency of adequate administration of prescribed X infused volume in patients undergoing ENT: *Number of patients with proper ENT volume* x 100 Total number of patients undergoing ENT TARGET = ≥ 80%
- Frequency of patients fasting before starting early ENT: *No. of ENT candidates fasting> 48h* x 100 *Total number of patients undergoing ENT* TARGET = <20%
- Frequency of diarrhea in patients undergoing ENT: *No. of patients undergoing ENT with diarrhea* x 100 Total number of patients undergoing ENT TARGET = ≤ 10%
- Frequency of episodes of constipation in patients undergoing ENT: *No. of patients undergoing ENT with constipation* x 100 *Total number of patients undergoing ENT* TARGET = <20%

BMI - body mass index; ENT - enteral nutritional therapy.

RESULTS

The sample consisted of 79 older adults, of whom 38% (n=30) were male and 62% (n=49) female. The study involved patients aged between 60 and 100 years, with an average of 72.5 years. The length of stay in the ICU ranged from 03 to 57 days of hospitalization, with a median of 14 days (interquartile range of 8-20 days). It was found that death occurred in 44.3% of the older adults surveyed (Table 1).

In relation to the QINTs, it was found that 89.87% (n=71) of the older adults had their BMI calculated at admission (**Ind1**); 84.61% (n=66) had their caloric and protein targets estimated (**Ind** 2); 54.66% (n=41) achieved the prescribed x infused volume (**Ind** 3), and 31.64% (n=25) had been fasting for more than 48 hours before starting NT (**Ind** 4). With regard to gastrointestinal complications, 34.2% (n=27) had diarrhea (**Ind5**) and 62.02% (n=49) had episodes of intestinal constipation (**Ind6**).

In Figure 1, all the QINTs analyzed are shown with their respective targets, recommended by the Brazil ILSI[11].

Table 1. Demographic, clinical and nutritional characteristics of patients undergoing enteral nutritional therapy in the ICU of a university hospital in the city of João Pessoa (Paraíba), 2019.

Variable	Mean	Median	±Standard-Deviation	Interquartile distance	n (%)
Age (years)*	72.5	71.0	9.4	(66.0-78.0)	-
Length of ICU stay (days) **	17.3	14.0	12.4	(8.0-20.0)	-
Duration of nutritional therapy**	12.4	9.0	10.9	(4.0-17.2)	-
Sex					
Male		-			30 (38.0)
Female		-			49 (62.0)
Outcome					
Discharge		-			44 (55.7)
Death		-			35 (44.3)

* Variable with normal distribution (mean and standard deviation); ** Variable with non-normal distribution (median and interquartile range)

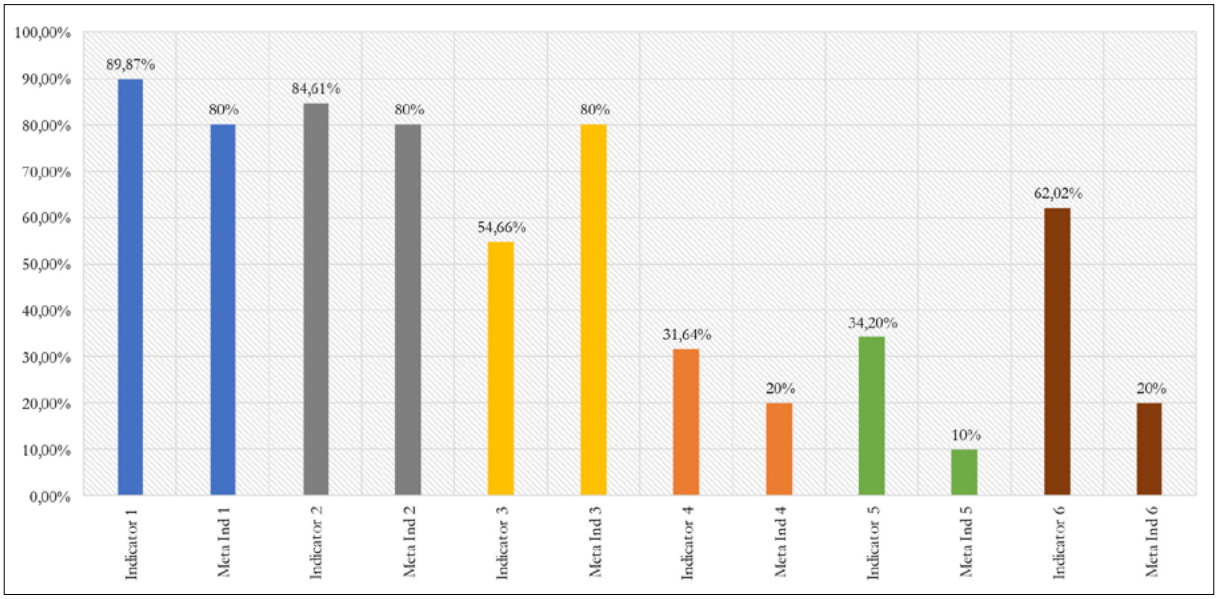

Figure 1. Quality indicators of patients receiving enteral nutritional therapy in the ICU of a university hospital in the city of João Pessoa (Paraíba), 2019.

Table 2 shows the association between length of hospital stay and the ENT quality indicators. No statistically significant association (p>0.05) was observed between length of stay and any of the quality indicators. However, the group of patients with over 14 days of hospitalization had a frequency of diarrhea of 43.6% and a frequency of constipation of 69.2%, whereas the group with 14 days or less of hospitalization had percentages of diarrhea of 25% and constipation of 55%, although the differences observed between the two groups were not statistically significant.

The statistical association between the clinical outcomes (hospital discharge and death) and the

QINTs in the patients is shown in Table 3. The data indicate that, among the group with an outcome of discharge, there was a higher frequency of BMI measurement (95.5% versus 82.9%), energy expenditure estimation (86.4% versus 80%), adequate infused vs. prescribed volume (65.9% versus 34.3%), than in the group that died.

Regarding gastrointestinal complications, the group that were discharged had a lower frequency of diarrhea (29.5% versus 40%) and a higher frequency of constipation (70.5% versus 51.4%) than the group that died. However, there was a statistically significant difference only in relation to the infused vs. prescribed volume (p=0.010).

Table 2. Association of quality indicators in patients undergoing ENT and days of ICU hospitalization in a public hospital in the city of João Pessoa (Paraíba), 2019.

Indicators	Length of stay n (%)		p
	≤14 days	>14 days	
Fasting			0.946[a]
≤ 48h	30 (75.0)	28 (71.8)	
> 48h	10 (25.0)	11 (28.2)	
BMI			0.263[b]
Measured	34 (85.0)	37 (94.9)	
Not measured	6 (15.0)	2 (5.1)	
EE estimate			0.116[b]
Estimated	31 (77.5)	35 (89.7)	
Not estimated	9 (22.5)	3 (7.7)	
Missing*	0 (0.0)	1 (2.6)	
Prescribed x infused volume *			0.052[a]
Yes	15 (37.5)	26 (66.7)	
No	21 (52.5)	13 (33.3)	
Missing*	4 (10.0)	0 (0.0)	
Episodes of diarrhea *			0.111[a]
Yes	10 (25.0)	17 (43.6)	
No	30 (75.0)	21 (53.8)	
Missing*	0 (0.0)	1 (2.6)	
Episodes of constipation			0.284[a]
Yes	22 (55.0)	27 (69.2)	
No	18 (45.0)	12 (30.8)	

[a] Yates correction; [b] Fisher's exact test * the values described as missing were disregarded in the inferential statistical analysis.

Table 3. Association of quality indicators undergoing ENT and days of ICU stay in a public hospital in the city of João Pessoa (PB), 2019.

Indicators	Outcome n (%)		*p*
	Discharge	Death	
Fasting			0.680[a]
≤ 48h	31 (70.5)	27 (77.1)	
> 48h	13 (29.5)	8 (22.9)	
BMI			0.129[b]
Measured	42 (95.5)	29 (82.9)	
Not measured	2 (4.5)	6 (17.1)	
EE estimate			0.356[b]
Estimated	38 (86.4)	28 (80.0)	
Not estimated	5 (11.3)	7 (20.0)	
Missing*	1 (2.3)	0 (0.0)	
Prescribed x infused volume *			0.010[a]
Yes	29 (65.9)	12 (34.3)	
No	13 (29.5)	21 (60.0)	
Missing*	2 (4.6)	2 (5.7)	
Episodes of diarrhea*			0.508[a]
Yes	13 (29.5)	14 (40)	
No	30 (68.2)	21 (60)	
Missing*	1 (2.3)	0 (0.0)	
Episodes of constipation			0.134[a]
Yes	31 (70.5)	18 (51.4)	
No	13 (29.5)	17 (48.6)	

[a] Yates correction; [b] Fisher's exact test * values described as missing were disregarded in the inferential statistical analysis.

DISCUSSION

The results obtained indicate poor performance in the quality indicators in nutritional therapy (QINTs) applied, as of the six indicators analyzed, only frequency of measurement of BMI at admission and frequency of measurement or estimate of energy expenditure and protein needs met the established targets. Thus, the present findings illustrate the need and importance of the application and monitoring of QINTs for the assessment of nutritional therapy of older patients admitted to the ICU.

The average age of the population studied was 72.5 years, with a prevalence of death in the total sample of 44.3%. In a study carried out with the objective of constructing a prognostic assessment instrument for older adults hospitalized in the ICU, 59.02% of the sample had an outcome of death[2], showing that the mortality rate in the studied population is high. Studies have shown that the mortality rate of the older population in intensive care units is between 28 and 62%[13,14].

It was observed that the QINTs were an effective tool for assessing the adequacy of NT, with the indicators used in the present study considered among the best by ILSI Brazil, as they are useful, practical, easy to perform and inexpensive[11]. In addition, of the six QINT used, the continuous application of five is suggested by the Sociedade Brasileira de Nutrição Parenteral e Enteral - The Brazilian Society of Parenteral and Enteral Nutrition (BRASPEN), with the objective of correcting flaws, redefining

targets and identifying any difficulties that may arise[15]. Most of the indicators analyzed in this study, with the exception of frequency of BMI measurement at admission and frequency of the measurement or estimate of energy expenditure and protein requirement, did not reach the established target.

A Ministry of Health ordinance (n. 272, dated April 8, 1998) which addresses the requirements for parenteral nutrition therapy, recognizes the importance of nutritional assessment as the first step in the diagnosis of the patient, and determines that it must precede nutritional therapy. While there is no gold standard for assessing nutritional status in the ICU, the use of all the methods available is recommended, in order to achieve greater reliability of nutritional diagnosis and, consequently, a more accurate definition of required treatment conduct[16]. BMI is a simple indicator of nutritional status and, like other evaluation parameters, has its limitations, especially regarding critical patients[17]. Of the sample analyzed, 89.9% (n=71) of hospitalized patients had their BMI calculated on admission. These results achieved the target of ILSI Brazil and corroborate the study by Sá and Marshall[18] on the use of QINTs, where the authors found a 100% frequency of BMI measurement during the evaluation period.

It was found that 31.6% (n=25) of the sample fasted for more than 48 hours before starting NT, with no statistically significant differences for this indicator among the clinical outcomes (p= 0.680) or length of stay (p=0.946). However, it is worth emphasizing the importance of the early onset of NT among critically ill patients, to achieve better clinical results. The advantages of the early onset of nutritional therapy have been well established among critical patients, and the tool can help mitigate metabolic changes[19]. When initiated, it may favor, among other aspects, an increase in protein synthesis and the improvement of lean body mass, and the maintenance of intestinal integrity (by reducing the permeability of this tissue), promoting an improvement in insulin sensitivity, increasing the absorptive capacity of the intestine and the reduction of inflammation and oxidative stress[20]. Bezerra and Cabral[21], in a retrospective case series study in an ICU, began ENT within up to 48 hours of admission in 75.3% of the sample and observed that in this group, the probability of progressing to discharge in the ICU was 1.22 times higher than in the group that started later (> 48h).

Of the older adults in this study, it was observed that the frequency of measurement or estimate of energy expenditure and protein requirement (84.61%, n=66) reached the target proposed by ILSI Brazil. However, no statistically significant differences were observed with the clinical outcomes (p= 0.356) or length of hospital stay (p=0.116). Alves and Borges[22], in a quantitative, retrospective study carried out at the Regional Hospital of Taguatinga, found that 58.6% of the sample achieved the target for the same indicator, and also that there was no significant difference with the clinical outcomes, with values of p=0.057 and p=0.455, respectively, for hospital discharge and death. However, they emphasize the importance of continuing to calculate the nutritional needs of patients to ensure appropriate NT.

It was found that 54.66% (n=41) of patients achieved the frequency of adequate administration of prescribed x infused volume, a figure below the proposed target (≥80%). However, a significant association was identified (p=0.010) between this indicator and clinical outcome, and it was observed that 65.9% (n=29) of patients who received the adequate prescribed volume were ultimately discharged. Stefanello and Poll[17] in their study, also found a low percentage (36.1%) of adequacy in the prescribed volume, in relation to the administration of the enteral formulation. Simões et al.[23], in an observational study with adults and older adults, observed, in the 50-80 years age group, that the infused volume was significantly less than the prescribed volume over five days of follow-up, and the same result was observed in the 81-100 year old age group.

Also in this regard, Stefanello and Poll[17] suggest that adjustments between the prescribed and the received enteral diet in terms of volume, calories and proteins need to be improved to meet the nutritional requirements of critically ill patients, and report that studies that exhibit positive results in this analysis are carried out in ICUs in which the monitoring of the quality/quantity of enteral nutrition has been carried out for some years, and with the meaningful involvement of the nutritional therapy

multidisciplinary team (NTMT). The adequate supply of nutrients maintains or restores nutritional status, while studies have evaluated prescription and the adequacy to reach an energy target as a strategy for improved clinical outcomes[24]. McClave et al.[25] observed that patients who received an enteral nutrition volume close to 100% of that prescribed, progressed to lower rates of infectious complications, reduced their length of hospitalization and tended to have lower mortality rates.

In the present study, the presence of gastrointestinal complications, such as diarrhea and constipation, was also assessed, with a prevalence of 34.2% and 62% respectively. Neither indicator exhibited values within the proposed target, and there was no association with number of days spent in the ICU or outcome. In their study, O'Meara, et al.[26] observed these complications in 25.6% of total patients. In the study by Bezerra et al.[27], however, episodes of diarrhea were less frequent (4%), reaching the ILSI Brazil target, which was associated with the exclusive use of EN in a closed system, resulting in a lower risk of contamination and better flow control. It is worth mentioning that diarrhea can be associated with several other causes, such as the rapid infusion of an enteral diet, bacterial contamination, hyperosmolar formula, drug treatments, hospital infections and even as a consequence of the underlying disease itself[28].

Some studies have also found a significant frequency of constipation. Batassini and Beghettoque[29], in a study carried out in an intensive care center composed of 40 clinical and surgical beds in a high-complexity Brazilian university hospital, found a higher frequency of constipation (75.8%). Prat et al.[30], in a prospective observational study carried out in two ICUs with 22 total beds, in two French university hospitals, obtained a similar frequency (51.9%). Therefore, several studies carried out in intensive care units confirm that constipation is a genuine complication in critically ill patients, and that the use of a protocol minimizes this incidence[31].

It should be mentioned that the applicability of QINTs in a unit requires that the clinical scenario be directed and standardized in accordance with the reality of the sector, and that the human resources are available to obtain positive results, reach targets and to allow a realistic selection of QINTs[8].

Although the present study has certain limitations, such as its non-probabilistic, convenience-type sampling, and did not adjust the association for possible confounding factors, such as the severity of illness and the age of patients, it contributes to an explanation of the panorama of quality indicators in nutritional therapy in older adults receiving care in the ICU of a public hospital. In addition, for some variables, there was a lack of information in the nutritional monitoring forms, as highlighted in Tables 2 and 3. It can be verified, therefore, that the control and daily recording of nutritional monitoring are extremely important, and essential for the analysis of the effectiveness of the therapy.

Another important limitation relates to prescribed vs. infused volume. In general, more severely ill patients have a clinical profile that leads to difficulty in adapting nutritional therapy. Mendonça and Guedes[7] in a study that monitored the adequacy of ENT in the ICU, described the importance of an adequate intake of nutrients and energy in critically ill patients, but highlighted that these patients often receive an energy value below their needs, due to factors that prevent adequate enteral nutritional intake, such as those related to diet intolerance (vomiting, diarrhea, gastric waste, abdominal distension, etc.), routine nursing practices (patient handling, administration of medication, etc.) and other routines (procedures, exams), which may have influenced the results in relation to the outcome.

CONCLUSION

It was observed that the indicator of the frequency of the adequate administration of the prescribed x infused volume was significantly associated with hospital discharge, suggesting that this indicator should be considered for the monitoring of nutritional care. However there is a need for further studies to assess the feasibility of applying quality indicators in nutritional therapy more broadly to improve the assessment of nutritional care for older adults.

It is noteworthy that of the six indicators analyzed in the study, four did not reach the targets for quality indicators in nutritional therapy, highlighting the need to develop action plans to ensure the effectiveness of the processes, and thus improve the results and efficiency of nutritional therapy, as effective nutritional therapy for older adults admitted to the ICU is extremely important.

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