Rev Rene. 2025;26:e95556.
DOI: 10.36517/2175-6783.20252695556
www.periodicos.ufc.br/rene

Original Article

Influence of an educational intervention for nursing staff on enteral nutritional therapy*

Influência de uma intervenção educativa para equipe de enfermagem na terapia nutricional enteral

How to cite this article:
Diniz AO, Meurer IR, Reis VN, Batista KC, Moreira APB, Silva SLA. Influence of an educational intervention for nursing staff on enteral nutritional therapy. Rev Rene. 2025;26:e95556. DOI: https://doi.org/10.36517/2175-6783.20252695556

Aline Oliveira Diniz[1]
Igor Rosa Meurer[1]
Valesca Nunes dos Reis[1]
Kely Cristine Batista[1]
Ana Paula Boroni Moreira[2]
Silvia Lanziotti Azevedo da Silva[2]

ABSTRACT

Objective: to analyze the effect of an educational intervention for nursing staff on enteral nutritional therapy. **Methods:** an interventional study was conducted using a pre-post, non-randomized design with no control group. The intervention targeted 260 nursing staff members (nurses and nursing technicians) at a public hospital. Over a 57-week period, three training cycles were delivered, featuring round table discussions on standardized subjects related to enteral nutrition. The effectiveness of the training was assessed using mixed linear regression models. **Results:** following the first and second training cycles, deficits in volume, calories, and protein were significantly reduced ($p<0.05$) in the hospital wards, starting from the fifth day of enteral nutritional therapy. While the percentages of nutritional adequacy increased in both the intensive care unit and the general wards, this trend did not reach statistical significance. **Conclusion:** implementing an educational intervention contributes to a measurable improvement in the quality of enteral nutritional therapy provided to patients. This constitutes a viable strategy for enhancing the overall efficiency and clinical effectiveness of this therapy. **Contributions to practice:** this study provides pioneering evidence on the implementation and impact of nursing-focused training on the mitigation of caloric and protein deficits associated with enteral nutritional therapy.

Descriptors: Enteral Nutrition; Energy Intake; Education; Nursing.

RESUMO

Objetivo: analisar o efeito de uma intervenção educativa para equipe de enfermagem na terapia nutricional enteral. **Métodos:** trata-se de estudo quase-experimental, pré e pós-teste, sem grupo controle, realizado com 260 enfermeiros e técnicos de enfermagem de um hospital público de ensino. A intervenção consistiu em três ciclos de treinamento em formato de mesas-redondas, realizados ao longo de 57 semanas, abordando temas recorrentes sobre a terapia nutricional enteral. O efeito da intervenção foi analisado por meio de modelos de regressão linear mistos. **Resultados:** observou-se redução significativa ($p<0,050$) nos *déficits* de volume calórico e proteico nas enfermarias a partir do quinto dia de terapia, após o primeiro e o segundo ciclos da intervenção. Verificou-se, também, aumento nas taxas de adequação nutricional tanto na unidade de terapia intensiva quanto nas enfermarias, contudo, sem alcançar significância estatística. **Conclusão:** a implementação da intervenção educativa demonstrou ser uma estratégia eficaz para a melhoria da qualidade da terapia nutricional enteral administrada a pacientes internados em enfermarias, contribuindo para aumentar sua eficiência e a sua eficácia. **Contribuições para a prática:** este estudo destaca-se pelo pioneirismo na implementação e avaliação do impacto de treinamentos com a equipe de enfermagem focados na redução dos *déficits* calórico-proteicos em terapia nutricional enteral.

Descritores: Nutrição Enteral; Ingestão de Energia; Educação; Enfermagem.

*Extracted from the dissertation "Análise do suporte nutricional enteral fornecido aos pacientes críticos e não críticos de um hospital universitário antes e após intervenção educativa", Universidade Federal de Juiz de Fora, 2024.

[1]Empresa Brasileira de Serviços Hospitalares, Hospital Universitário. Juiz de Fora, MG, Brazil.
[2]Universidade Federal de Juiz de Fora. Juiz de Fora, MG, Brazil.

Corresponding author:
Silvia Lanziotti Azevedo da Silva
Av. s/n; Dom Bosco. Eugênio do Nascimento.
CEP: 36038-330. Juiz de Fora, MG, Brazil.
E-mail: silviafisiojf@yahoo.com.br

Conflict of interest: the authors have declared that there is no conflict of interest.

Received: Jun. 16th 2025; Accepted: Jul. 18th 2025.

Introduction

Disease-related malnutrition represents a global public health problem, being both common and costly[1]. In the context of Latin America, the prevalence of nutritional risk reaches 39.6%, with more than 50% of patients presenting with weight loss prior to hospitalization, which increases the risk of mortality sixfold[2]. This situation is often aggravated in the hospital environment, where acquired malnutrition affects up to 65% of individuals, potentially delaying recovery and promoting functional decline[3-4].

Nutritional therapy is the best strategy for the prevention and treatment of malnutrition[5-7], as it is considered the main tool to ensure adequate intake of calories and proteins in critically ill patients or those unable to spontaneously meet their nutritional needs[6-7]. Enteral Nutritional Therapy (ENT) is the preferred route of administration, capable of exerting a favorable impact on patient outcomes, as it reduces the severity of diseases, the occurrence of infectious complications, the length of hospital stay[6], and the mortality rate[8]. Such results can be achieved with the early introduction of nutritional therapy (within 48 hours) to provide adequate calories, as well as macro and micronutrients, and meticulous glycemic control[7]. For the clinical benefits of nutritional therapy to be achieved in the first week of hospitalization, more than 80% of the estimated caloric and protein goals should be met within 48 to 72 hours after the start of nutritional support, and complete nutritional support (100%) should be achieved between three and seven days[7-8].

Conversely, inadequate nutrition can lead to nutritional disorders and malnutrition, significantly worsening the clinical prognosis[9]. Consequently, insufficient nutritional support contributes to reduced survival rates, increased lengths of hospital stay, and higher healthcare costs[10].

Despite the established role of caloric and protein deficits in patient outcomes[7], the literature consistently reports the prevalence of caloric and protein inadequacy in the hospital setting[10-14]. This highlights the need for effective tools to minimize these deficits. Continuous professional development, such as the "permanent health education" model advocated by the Brazilian Health Ministry, integrates on-the-job learning with daily work activities to shape and improve clinical practices[15]. This educational model enables reflection on work processes, promotes institutional change, and transforms the practices of healthcare providers through teamwork and structured learning routines[16]. Such educational activities are considered an effective strategy for improving caloric-protein adequacy, encouraging the use of protocols, ensuring accurate documentation, and enhancing the performance of the Multidisciplinary Nutritional Therapy Team (MNTT)[12-14].

Based on the analysis of an educational intervention, this study can contribute to increasing the safety of professionals involved in the administration of ENT through strategic educational initiatives and to the improvement of patient care. The study can provide readers with a more comprehensive, in-depth, and innovative perspective on the processes involved in specialized ENT care. Considering the negative effects of caloric and protein deficits on patient outcomes and the need for research with interventions aimed at increasing the efficiency and effectiveness of ENT, the objective of the present study was to analyze the effect of an educational intervention for nursing staff on enteral nutritional therapy.

Methods

Study design and target population

A quasi-experimental pre- and post-test study was conducted without a control group, involving nurses and nursing technicians working in the medical and surgical clinic units and the Intensive Care Unit (ICU) of a public teaching and research hospital that performs outpatient procedures and highly complex surgeries. To ensure clarity, completeness, and trans-

parency in the results, the *Transparent Reporting of Evaluations with Nonrandomized Designs* (TREND) checklist was used[17].

The study was conducted from May 2021 to August 2023 and was subdivided into four periods: pre-intervention (pre), intervention period 1 (IP-1), intervention period 2 (IP-2), and intervention period 3 (IP-3). The hypothesis is that educational interventions can reduce nutritional deficits and improve the caloric-protein supply to patients on ENT.

The pre-intervention period (pre) lasted 57 weeks, starting on 05/24/2021 and ending on 06/26/2022. The intervention period also lasted 57 weeks (07/11/2022 to 08/13/2023) and was divided into 3 periods (IP-1, IP-2, and IP-3), each lasting 19 weeks (IP-1 was from 07/11/2022 to 11/20/2022, IP-2 from 11/21/2022 to 04/02/2023, and IP-3 from 04/03/2023 to 08/13/2023). Each intervention period was preceded by a two-week training cycle, with the 1st cycle conducted from 06/27/2022 to 07/10/2022 (without data collection), the 2nd cycle from 11/07/2022 to 11/20/2022, and the 3rd cycle from 03/20/2023 to 04/02/2023.

Educational intervention: training cycles

The educational intervention consisted of three training cycles conducted during the intervention period, with 19-week intervals between cycles. The target population for the intervention was all nurses and nursing technicians assigned to the sectors of interest (wards and ICU) and, therefore, directly involved in the administration of ENT. Professionals who were relocated to other sectors during the intervention period discontinued the training, and those professionals who were admitted to the sectors of interest during the intervention period participated in the training sessions held from their admission date to the sector. To reach a larger number of nurses and nursing technicians, the training sessions were scheduled with the coordinators of each sector (wards and ICU), took place at the respective workstations of the nursing staff during work hours, and were previously communicated to the professionals by their respective coordinators. All professionals assigned to the service at the time of the training sessions were eligible for inclusion.

Each session lasted 30 minutes. The sessions occurred across all three shifts (morning, afternoon, and night) on strategic days. The training was conducted with each of the 17 participating nursing teams in each of the three cycles, totaling 51 sessions. As the hospital's nursing staff works in different shifts (morning, afternoon, and night) and some employees were on vacation or leave during one of the training cycles, participants were encouraged to act as multipliers of the information acquired in the sessions.

The training sessions were delivered by two nurses from the MNTT, with the support of a nutritionist. Using a "conversation circle"[18] strategy, the sessions were conducted at the workplace with a dialogical approach to enable dialogue among professionals and encourage collective participation in reflecting on factors that could lead to the inadequate administration of ENT, aiming to improve their performance. Some printed documents (institutional vomiting protocol, nutritional prescription, and control chart) and some materials for practical demonstrations (30 to 60 mL syringes and a controlled infusion pump specific for enteral nutrition administration) were used as resources to facilitate communication.

The nursing team received guidance on the management of enteral diets and the standard operating procedures established by the MNTT for patients on catheter-delivered ENT. The following topics were addressed: a) maintenance of ENT catheter patency; b) techniques for unblocking ENT catheters; c) control of ENT catheter positioning; d) execution of the institutional vomiting protocol; e) occurrence of diarrhea; f) information recording; g) management of the controlled infusion pump; and h) instructions for executing the nutritional prescription. These topics were covered in all three training cycles to enhance the retention of acquired knowledge and ensure the standardization of methods.

Data collection

In the hospital, patients on catheter-delivered ENT are monitored daily by the MNTT. The calculations of caloric and protein needs are performed following institutional protocols and the recommendations of the American Society for Parenteral and Enteral Nutrition[6], the European Society for Clinical Nutrition and Metabolism[7], and the Brazilian Society of Parenteral and Enteral Nutrition[5].

The progression of the infusion rate for enteral diets follows the protocol established by the MNTT, starting at 50% (first day of ENT – D1) and progressing at 24-hour intervals (after team evaluation) to 65%, 80%, and 100% of the calculated needs. Thus, the dietary prescription reaches 100% adequacy in relation to caloric and protein needs on the fifth day (D5) of nutritional support.

The evaluation of the intervention's effect on the administration of ENT was carried out by analyzing variables related to nutritional support procedures, including the provision of enteral nutrition, with comparisons of the same variables across the four periods (pre, IP-1, IP-2, and IP-3). Data were obtained from structured Microsoft Excel spreadsheets used by the MNTT for patient monitoring, prepared by the coordinating team. The information contained in these spreadsheets comes from the service's routine (namely: nutritional needs, prescribed and administered volume, and prescribed and administered caloric and protein intake) and is recorded daily by professionals until the interruption of ENT, death, hospital discharge, or patient transfer. For the collection of data used in this study, a new Microsoft Excel spreadsheet was created to record the variables of interest, in exactly the same way as the original spreadsheet, before and after the intervention. Data were collected on enteral diet infusion procedures in adult patients (19 years or older) of both sexes, hospitalized in the ICU and wards on exclusive catheter-delivered ENT. Data from 137 procedures were excluded, referring to patients on ENT for less than 72 hours, pregnant women, and those in palliative care or with terminal illnesses.

Data from the pre-intervention period (pre) were collected before the first training cycle, over 57 weeks, the same duration as the entire intervention period. No data were collected on the administration of ENT during the first training cycle to avoid gathering information on the performance of trained and untrained professionals simultaneously, as all professionals were only equally trained at the end of the first training cycle.

The dependent variables of interest were: deficits in infused volume, calories, and proteins in relation to prescribed values, and the adequacy of volume, calories, and proteins (percentage of established goals). For each variable, the nutritional support was subdivided based on the day of administration to determine the period in which the supply was most affected (critical point): support offered from the first (D1) to the fourth day (D4) of ENT and support offered from the fifth day (D5) onwards.

Data analysis

Mean and standard deviation (SD) values were calculated for each continuous variable related to the provision of enteral nutrition in the pre-intervention period (pre) and in the three intervention periods (IP-1, IP-2, and IP-3). The analysis was stratified based on the setting: ICU or wards.

To assess the effect of the intervention, the same variables were considered across all periods. All variables showed a normal distribution according to the Shapiro-Wilk test ($p>0.05$). Linear mixed models were used to determine the differences in variables between the assessment time points (pre- and post--each training cycle) and the potential effect of the intervention. The beta coefficients for each intervention, compared with the pre-intervention period, were calculated to identify changes (increase or decrease) in the mean of each variable at each assessment point in the ICU and the wards. The linear mixed models allowed for the analysis of the fixed effect of the intervention while controlling for the random effect resulting

from differences in nutritional support in each intervention period.

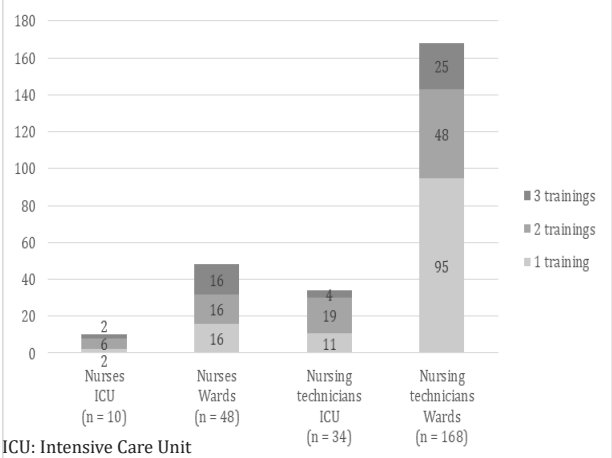
All analyses were performed with the aid of the R statistical package, version 4.3.1, 2002, with a significance level of 5% ($p<0.05$) and a 95% confidence interval (CI).

Ethical considerations

This study received approval from the Human Research Ethics Committee of the university hospital affiliated with the *Universidade Federal de Juiz de Fora* (Certificate of Presentation for Ethical Consideration No. 46668121.5.0000.5133; Protocol No. 4,825,877/2021). All participants provided signed informed consent.

Results

Throughout the intervention period, 51 training sessions were held, involving a total of 260 nursing staff professionals (58 nurses and 202 nursing technicians) who participated in at least one of the training cycles. Adherence to the intervention was progressive, with 51.9% participation in the first cycle, 57.7% in the second, and 60.8% in the third. Figure 1 details the distribution of professionals according to the number of training cycles in which they participated.



ICU: Intensive Care Unit

Figure 1 – Distribution of nurses and nursing technicians according to the number of training cycles in which they participated. Juiz de Fora, MG, Brazil, 2024

Among the nurses, 10 from the ICU and 48 from the wards participated in at least one training cycle. Of the 10 ICU nurses, the majority (60%) participated in two cycles. And among the 48 ward nurses, a similar number participated in 1, 2, and 3 cycles. Among the nursing technicians, 34 from the ICU and 168 from the wards participated in at least one training cycle. Of the 34 from the ICU, the majority (55.9%) participated in two cycles. And among the 168 nursing technicians from the wards, the majority (56.6%) participated in one cycle (Figure 1).

A total of 228 nutritional support procedures were performed for patients on ENT in the pre-intervention period, 83 in IP-1, 66 in IP-2, and 63 in IP-3.

Table 1 presents the means of the cumulative totals of deficits and adequacy rates for diet volume, calories, and proteins in relation to the nutritional prescription for each procedure. All mean adequacy rates for the cumulative totals of enteral diet volume, calories, and proteins were above 80%, demonstrating that the nutritional support was adequate in all periods (pre, IP-1, IP-2, and IP-3) and in both settings (ICU and wards) analyzed.

The analysis of the variation in adequacy rates for diet volume, calories, and proteins throughout the intervention period revealed that better results were achieved in the wards during IP-3 (after the third training cycle) in the initial days of ENT (D1 to D4), while the highest adequacy rate in the subsequent days (D5+) occurred in IP-2 (after the second intervention). In the ICU, the nutritional supply from D1 to D4 was better after the second intervention, and a better adequacy rate in the subsequent days (D5+) occurred after the third training cycle. With regard to deficits of volume, calories, and protein in relation to the dietary prescription, these values were inversely proportional to the adequacy rates in the wards (Table 1).

As demonstrated in Table 2, the beta coefficients revealed no increase or decrease in mean adequacy rates of diet volume, calories, and protein in either of the two settings (wards and ICU), with no statistically significant differences in adequacy rates among the intervention periods.

Table 1 – Mean (± standard deviation) deficient and adequacy rates of diet volume, calories and protein in pre-intervention period (pre) and intervention periods (IP-1, IP-2 and IP-3) in intensive care unit and wards. Juiz de Fora, MG, Brazil, 2024

Variable	Intensive Care Unit				Wards			
	Pre (Mean ± SD)	IP-1 (Mean ± SD)	IP-2 (Mean ± SD)	IP-3 (Mean ± SD)	Pre (Mean ± SD)	IP-1 (Mean ± SD)	IP-2 (Mean ± SD)	IP-3 (Mean ± SD)
Volume deficit (ml)								
D1 to D4*	238.86 ±339.62	146.94 ±201.86	157.27 ±240.21	216.88 ±307.27	344.94 ±403.05	321.92 ±352.75	310.50 ±306.18	176.94 ±234.84
D5+†	1731.57 ±2120.99	240.16 ±1493,44	1144.59 ±1068.03	1860.11 ±2644.68	1498.84 ±1772.46	741.22 ±946.01	524.57 ±613.97	984.06 ±1412.19
Adequacy of volume (%)								
D1 to D4	89.22 ±15.25	92.65 ±11.66	93.84 ±10.37	89.88 ±13.28	87.99 ±13.11	88.73 ±11.68	88.49 ±11.91	91.66 ±12.17
D5+	86.28 ±16.52	86.72 ±16.52	83.82 ±19.63	91.96 ±7.12	89.65 ±13.01	91.37 ±10.36	93.93 ±7.20	92.16 ±10.25
Calorie deficit (Kcal)								
D1 to D4	341.78 ±497.28	223.82 ±308.00	236.26 ±372.07	325.32 ±460.90	496.14 ±588.92	482.94 ±538.55	473.71 ±454.84	252.14 ±348.17
D5+	2132.79 ±2269.93	1635.39 ±1826.57	1685.76 ±1602.17	2673.83 ±3882.28	2068.30 ±2440.12	1108.93 ±1401.15	776.43 ±893.80	1474.36 ±2182.16
Caloric adequacy (%)								
D1 to D4	89.18 ±15.09	92.58 ±11.70	93.85 ±11.40	89.71 ±13.42	87.97 ±12.99	88.69 ±11.62	88.41 ±11.73	91.55 ±12.29
D5+	87.94 ±19.60	88.62 ±11.79	83.84 ±19.47	91.76 ±7.45	89.75 ±13.08	89.83 ±14.14	93.71 ±7.20	91.92 ±10.33
Protein deficit (g)								
D1 to D4	19.38 ±29.53	11.12 ±15.88	11.79 ±16.85	17.70 ±23.79	29.48 ±52.47	20.28 ±24.76	20.32 ±19.80	10.66 ±14.48
D5+	139.29 ±155.73	82.60 ±93.91	77.36 ±74.91	135.61 ±202.56	104.67 ±113.63	50.91 ±62.36	34.24 ±40.06	67.01 ±102.83
Protein adequacy (%)								
D1 to D4	89.40 ±15.79	92.51 ±12.04	93.39 ±9.59	89.17 ±13.35	86.91 ±16.18	88.81 ±11.66	89.13 ±10.93	92.29 ±11.38
D5+	87.02 ±15.24	88.21 ±12.50	84.14 ±19.89	92.47 ±6.82	89.34 ±13.59	90.00 ±13.83	94.03 ±7.12	92.13 ±10.49

*D1 to D4: First to fourth day of enteral nutritional therapy; †D5+: Beginning with the fifth day of enteral nutritional therapy; IP: Intervention periods; SD: Standard deviation

Table 2 – Stratified analysis of deficits and adequacy rates of diet volume, calories and protein in pre-intervention period (pre) and intervention periods (IP-1, IP-2 and IP-3). Juiz de Fora, MG, Brazil, 2024

Variable	Intensive Care Unit (n = 130)					Wards (n=98)				
	Random effect	Fixed effect				Random effect	Fixed effect			
		Intercept	Beta 1	Standard error	p-value		Intercept	Beta 1	Standard error	p-value
Volume deficit D1 to D4*	0.050	238.86				0.026	344.94			
IP-1			-51.24	62.28	0.412			-23.02	98.46	0.816
IP-2			-81.59	61.51	0.187			-34.44	107.24	0.749
IP-3			-21.98	62.28	0.729			-168.00	98.46	0.095
Volume deficit D5+†	0.312	1731.57				1154.69	1510.89			
IP-1			157.87	440.60	0.721			-598.07	265.35	0.026‡
IP-2			-586.98	396.14	0.142			-739.56	281.94	0.010‡
IP-3			128.53	440.60	0.771			-345.94	269.54	0.202
Adequacy volume D1 to D4	0.002	89.21				0.000	87.99			
IP-1			1.35	2.84	0.636			0.74	3.49	0.833
IP-2			4.61	2.80	0.103			0.49	3.80	0.896
IP-3			0.65	2.84	0.817			3.67	3.49	0.299
Adequacy volume D5+	0.001	86.27				5.766	89.59			
IP-1			-0.47	3.53	0.894			1.39	2.27	0.541
IP-2			-2.45	3.18	0.441			3.87	2.41	0.111
IP-3			5.68	3.53	0.112			2.38	2.30	0.302
Calorie deficit D1 to D4	0.075	341.78				0.039	496.13			
IP-1			-56.34	92.32	0.543			-13.19	145.20	0.928
IP-2			-105.52	91.18	0.250			-22.42	158.14	0.887
IP-3			-16.46	92.32	0.858			-243.99	142.64	0.094
Calorie deficit D5+	103.65	2132.67				1428.58	2082.94			0.039‡
IP-1			-81.82	531.62	0.878			-817.67	390.79	0.014‡
IP-2			-446.55	477.96	0.352			-1039.48	415.25	0.269
IP-3			542.03	531.61	0.310			-441.46	396.85	0.039‡
Caloric adequacy D1 to D4	0.002	89.17				0.000	87.96			
IP-1			1.33	2.85	0.641			0.71	3.47	0.837
IP-2			4.67	2.81	0.100			0.44	3.78	0.908
IP-3			0.52	2.85	0.853			3.57	3.47	0.309
Caloric adequacy D5+	0.001	87.93				5.311	89.70			
IP-1			0.52	3.79	0.891			-0.18	2.45	0.940
IP-2			-4.10	3.41	0.233			3.64	2.60	0.165
IP-3			3.81	3.79	0.317			2.08	2.48	0.403
Protein deficit D1 to D4	0.003	19.38				33.525	27.959			
IP-1			-5.21	5.20	0.318			-2.93	9.26	0.752
IP-2			-7.59	5.14	0.143			-2.70	10.02	0.788
IP-3			-1.68	5.20	0.746			-12.71	9.20	0.174
Protein deficit D5+	0.030	139.29				66.351	105.39			
IP-1			-40.23	32.22	0.215			-46.31	18.22	0.012‡
IP-2			-61.92	28.97	0.035§			-59.10	19.36	0.003‡
IP-3			-3.68	32.22	0.909			-29.57	18.50	0.113
Protein adequacy D1 to D4	0.002	89.40				0.000	86.91			
IP-1			0.98	2.90	0.734			1.89	3.85	0.625
IP-2			3.98	2.87	0.168			2.21	4.20	0.600
IP-3			-0.23	2.90	0.936			5.38	3.85	0.170
Protein adequacy D5+	0.001	87.01				6.163	89.28			
IP-1			1.83	3.20	0.569			0.58	2.45	0.810
IP-2			-2.87	2.87	0.320			4.68	2.60	0.075
IP-3			-5.45	3.20	0.092			2.98	2.48	0.233

*D1 to D4: First to fourth day of enteral nutritional therapy; †D5+: Beginning with the fifth day of enteral nutritional therapy; ‡Significance based on 95%CI; IP: Intervention period

According to Table 2, for nutritional support offered in the wards beginning with the fifth day of ENT, the beta coefficients demonstrated a statistically significant reduction in volume, calorie, and protein deficits in IP-1 and IP-2. In the ICU, the beta coefficients revealed a statistically significant reduction in protein deficit resulting from nutritional support offered from D5+ onward in IP-2 (p=0.035).

Discussion

Each of the three training cycles involved most the hospital's nursing staff. This significant adherence rate can be attributed to the intervention format: sessions were scheduled in advance with coordinators, took place *in loco* during working hours, and were consistent with routine. This approach facilitated familiarity with the real work context while ensuring continuity of care.

Continuing health education initiatives, when conducted as part of the institutional routine, encourage team participation because they demand little time from professionals and do not impose costs. The involvement of leadership in this process is a crucial factor for participant adherence and engagement, as a greater understanding of the educational process by managers enables the planning of strategies that promote the value of health practices[19].

A similar process demonstrated this effectiveness when training 48 nursing professionals from an ICU to improve the prevention of ventilator-associated pneumonia. On that occasion, the training was also conducted during working routine in short, 20-minute sessions and was initiated at the request of the nursing coordinator, reinforcing the positive impact of management support[20].

In this study, the encouragement of active participation in the collective analysis of the work process of the nursing staff enabled the participants to hold each other accountable for the production of autonomy and care. This proposal is in line with permanent health education, by which collective analysis should occur in the dynamics of roundtable discussions, addressing problems and difficulties related to social and labor practices experienced in the daily life of organizations[21].

Throughout the intervention period, enteral nutritional support in both the ICU and wards was in accordance with the guidelines of the American and European societies of parenteral and enteral nutrition, which state that nutritional support should maintain a provision of more than 80% of estimated caloric and protein targets. Indeed, it has been demonstrated that the ideal caloric intake associated with a greater survival rate is around 80% of estimated energy needs[6-7].

Difficulties are observed in meeting nutritional goals, resulting in underfeeding rates — that is, a caloric-protein intake below 80% of the target — with rates of 25%[22], 54%[13], and 87.5%[12] being found on days when enteral nutrition is interrupted. These data show the variation in mean caloric-protein adequacy in recent studies. In contrast, the satisfactory rates found in the present investigation reflect the quality of care offered to patients on ENT at the hospital where this study was developed.

Despite the increase in adequacy rates in comparison to the pre-intervention assessment in both the ICU and wards in the first four days (D1 to D4) and beginning with the fifth day (D5+) of ENT, the increase was not significant in any of the three intervention periods. This result was likely because nutritional support was already adequate prior to the interventions, with adequacy rates higher than 80%, leading to a low potential for improvement. The adequacy of enteral nutritional support prior to the intervention can be attributed to the work of the MNTT as well as the use of quality indicators and protocols already implemented in the hospital at which this study was developed. The use of quality indicators, the adoption of protocols, and the active participation of the MNTT have the potential to minimize the occurrence of factors associated with inadequate ENT administration, thus enhancing the quality of care[23].

Enteral nutritional support for critically ill pa-

tients was monitored over a five-year period, revealing an increase in the adequacy rates for volume, calories, and protein, with a significant difference observed between the first and fifth years of follow-up. However, the adequacy rates were low at the start of the study (73.9% for volume, 74.4% for calories, and 74.1% for protein). The improvement was attributed to the implementation of an ENT infusion protocol, the role of the MNTT, and the delivery of health education activities; the first two of these were already in place at the hospital where the present study was conducted[24].

The effect of a multifaceted nutritional educational intervention directed at medical staff on the quality of nutritional therapy, as well as clinical outcomes of patients in an ICU, was also assessed. Before the intervention, the initial adequacy rate was lower than that stipulated in nutritional therapy guidelines. After the intervention, an improvement in nutritional adequacy was found, which went from 74.2% in the pre-intervention period to 96.2% in the post-intervention period ($p<0.001$). Improvements were also found in other outcomes after the intervention, such as a reduction in the average duration of fasting from 3.8±3.1 days to 2.2±2.6 days ($p<0.002$), an increase in the early onset of ENT from 24% to 60% ($p<0.001$), and a reduction in the length of hospital stay from 18.5 days to 9.5 days ($p<0.001$)[25].

In the wards, a significant reduction was found in volume, calorie, and protein deficits in relation to the dietary prescription beginning with D5 of ENT in both the IP-1 and IP-2 periods, indicating that one and two interventions were sufficient for the improvement in the provision of the enteral diet. In the ICU, a significant reduction was found only with regard to protein deficit after the second training cycle.

The fact that the improvement in nutritional support was only found beginning with D5 of ENT may be attributed to the greater number of days analyzed in this period (D5 to the cessation of enteral nutritional support), compared to the analysis of only the first four days. The literature reports that the number of days on ENT is directly proportional to the quantity of calories and protein consumed per day[14]. Thus, nutritional deficits are associated with the length of time on ENT.

The reduction in deficits and consequent increase in caloric-protein offer provides benefits for patients on ENT, contributing to better clinical results, such as reductions in mortality, ICU and hospital stay, mechanical ventilation duration, and incidence of nosocomial infection[26]. When an early enteral nutrition protocol was applied in ICU patients, the intervention group demonstrated significantly higher calorie intake and protein intake than the control group and, furthermore, significantly higher hemoglobin and albumin and shorter ICU length of stay ($p<0.05$)[9].

The constant monitoring of adequacy between dietary prescription and ENT administration should be encouraged to contribute to the implementation of measures that promote the improvement in nutritional care for hospitalized patients. The continual training of the healthcare team is necessary to ensure a reduction in nutritional deficits and the enhancement of care quality[12]. One of the tools for this is permanent health education, as presented in this study.

The present results demonstrate that the intervention was more effective in the wards and that two interventions were enough to promote a significant improvement in nutritional support. It is possible that the greater impact of training in the wards is related to the work process of nursing staff in ICUs, who provide care for critically ill patients that require more rigid control in the fulfillment of protocols. The deficits in the ICU may be attributed to factors related to the clinical complications inherent to critically ill patients.

Study limitations

This study has some limitations that must be considered. All patients receiving enteral nutrition therapy during the study period were included; therefore, the characteristics of the participants may differ from those found in other hospitals, which could compromise the generalizability of the results.

The reallocation of professionals to other departments during the 54-week intervention period led to the discontinuation of their participation in subsequent training cycles. Furthermore, as the data were collected from instruments used by the institution's staff, there is a possibility of errors due to incomplete information recording.

Contributions to practice

Separately investigating the caloric and protein delivery in the ICU and wards allows for the recognition of the heterogeneity of patient and staff characteristics in these two distinct settings. Furthermore, no studies were found that evaluated the outcomes of training for nursing staff directly or indirectly involved in the administration of ENT. This is, therefore, a pioneering study in investigating the effect of training conducted with nursing staff on caloric and protein deficits in tube-fed ENT administered to hospitalized patients.

Thus, dialogical educational interventions that encourage the active participation of the nursing team and are adapted to the institution's daily routine can be used as a valid strategy to enhance the effectiveness of enteral nutrition therapy, contributing to high-quality nutritional care.

Conclusion

The evidence showed that the implemented training cycles helped optimize nutritional delivery through enteral nutrition therapy, even though nutritional support was already adequate (> 80%) in the hospital where this study was conducted prior to the interventions. The involvement of coordinators and the active role of the multidisciplinary nutritional therapy team were instrumental in the nursing team's adherence to guidelines and best practices.

Acknowledgments

The authors thank the nursing staff, unit coordinators, and members of the Multidisciplinary Nutritional Therapy Team who participated in and supported this research.

Authors' contributions

Conception and design, analysis and interpretation of data, writing the manuscript, and relevant critical review of the intellectual content: Diniz AO, Meurer IR, Silva SLA. Final approval of the version to be published and responsibility for all aspects of the text, ensuring the accuracy and integrity of any part of the manuscript: Diniz AO, Meurer IR, Reis VN, Batista KC, Moreira APB, Silva SLA.

References

1. Inciong JFB, Chaudhary A, Hsu HS, Joshi R, Seo JM, Trung LV, et al. Economic burden of hospital malnutrition: a cost-of-illness model. Clin Nutr ESPEN. 2022;48:342-50. doi: https://doi.org/10.1016/j.clnesp.2022.01.020
2. Correia MITD, Sulo S, Brunton C, Sulz I, Rodriguez I, Gomez G, et al. Prevalence of malnutrition risk and its association with mortality: nutrition Day Latin America survey results. Clin Nutr. 2021;40(9):5114-21. doi: http://doi.org/10.1016/j.clnu.2016.06.025
3. Pinheiro VE, Ribeiro AS, Camillo CAM, Casonatto J. Undernutrition risk is independently associated with worsened indicators of hospital rehabilitation in COVID-19 patients. Hosp Pract (1995). 2023;51(5):267-74. doi: https://doi.org/10.1080/21548331.2023.2277680
4. Cass AR, Charlton KE. Prevalence of hospital-acquired malnutrition and modifiable determinants of nutritional deterioration during inpatient admissions: a systematic review of the evidence. J Hum Nutr Diet. 2022;35(6):1043-58. doi: https://doi.org/10.1111/jhn.13009

5. Castro MG, Ribeiro PC, Matos LBN, Abreu HB, Assis T, Barreto PA. Guidelines in Practice - BRASPEN Guideline for Nutritional Therapy in the Critically Ill Patient. BRASPEN J. 2023;38(Supl 2):2-46. doi: https://doi.org/10.37111/braspenj.diretriz-DOENTEGRAVE

6. Compher C, Bingham AL, McCall M, Patel J, Rice T, Braunschweig C, et al. Guidelines for the provision of nutrition support therapy in the adult critically ill patient: The American Society for Parenteral and Enteral Nutrition. JPEN J Parenter Enteral Nutr. 2022;46:12-41. doi: https://dx.doi.org/10.1002/jpen.2267

7. Singer P, Blaser AR, Berger MM, Calder PC, Casaer M, Hiesmayr M, et al. ESPEN practical and partially revised guideline: Clinical nutrition in the intensive care unit. Clin Nutr. 2023;42(9):1671-89. doi: https://doi.org/10.1016/j.clnu.2023.07.011

8. Melchers M, Hubertine Hermans AJ, Hulsen SB, Kouw IWK, Zanten ARH. Individualised energy and protein targets achieved during intensive care admission are associated with lower mortality in mechanically ventilated COVID-19 patients: The COFEED-19 study. Clin Nutr. 2023;42(12):2486-92. doi: https://doi.org/10.1016/j.clnu.2023.10.002

9. Xu W, Ding X. The application effectiveness of an early enteral nutrition protocol constructed based on the enhanced recovery after surgery concept in ICU patients. Medicine (Baltimore). 2025;104(18):e42292. doi: http://dx.doi.org/10.1097/MD.0000000000042292

10. Pouwels S, van Nieuwkoop MM, Ramnarain D. Enteral nutrition interruptions in the intensive care unit: a systematic review of frequency, causes, and nutritional implications. Cureus. 2025;17(4):e81834. doi: http://doi.org/10.7759/cureus.81834

11. Lopez-Delgado JC, Grau-Carmona T, Mor-Marco E, Bordeje-Laguna ML, Portugal-Rodriguez E, Lorencio-Cardenas C, et al. Parenteral nutrition: current use, complications, and nutrition delivery in critically Ill patients. Nutrients. 2023;15(21):46-65. doi: https://doi.org/10.3390/nu15214665

12. Pawluk EC, Schiessel DL, Ribas HO, Uchida NS, Eing KKC, Schmitt V. Nutritional status association with protein-calorie adequacy in critically ill patients admitted to an intensive care unit. BRASPEN J. 2023;38(4):327-34. doi: https://dx.doi.org/10.37111/braspenj.2023.38.4.01

13. Salciute-Simene E, Stasiunaitis R, Ambrasas E, Tutkus J, Milkevicius I, Sostakaite G, et al. Impact of enteral nutrition interruptions on underfeeding in intensive care unit. Clin Nutr. 2021;40(3):1310-7. doi: https://doi.org/10.1016/j.clnu.2020.08.014

14. Santana MMA, Vieira LL, Dias DAM, Braga CC, Costa RM. Inadequate energy and protein and associate factors in critically ill patients. Rev Nutr. 2016;29(5):645-54. doi: https://dx.doi.org/10.1590/1678-98652016000500003

15. Ministério da Saúde (BR). Portaria de Consolidação GM/MS nº 02. Dispõe sobre a Política Nacional de Educação Permanente em Saúde como estratégia do Sistema Único de Saúde para a formação e o desenvolvimento de trabalhadores para o setor e dá outras providências [Internet]. 2017 [cited Jan 22, 2025]. Available from: https://bvsms.saude.gov.br/bvs/saudelegis/gm/2017/prc0002_03_10_2017.html

16. Ministério da Saúde (BR). Política Nacional de Educação Permanente em Saúde: o que se tem produzido para o seu fortalecimento? [Internet]. 2018 [cited Feb 2, 2025]. Available from: https://bvsms.saude.gov.br/bvs/publicacoes/politica_nacional_educacao_permanente_saude_fortalecimento.pdf

17. Jarlais DCD, Lyles C, Crepaz N, TREND Group. Improving the reporting quality of nonrandomized evaluations of behavioral and public health interventions: the TREND statement. Am J Public Health. 2004;94(3):361-6. doi: https://doi.org/10.2105/ajph.94.3.361

18. Warschauer C. Entre na roda: a formação humana nas escolas e nas organizações. São Paulo: Paz e Terra; 2017.

19. Ogata MN, Silva JAM, Peduzzi M, Costa MV, Fortuna CM, Feliciano AB. Interfaces between permanent education and interprofessional education in health. Rev Esc Enferm USP. 2021; 55:e03733. doi: https://doi.org/10.1590/S1980-220X2020018903733

20. Branco A, Lourençone MAS, Monteiro AB, Fonseca JP, Blatt CR, Caregnato RCA. Education to prevent ventilator-associated pneumonia in an intensive care unit. Rev Bras Enferm. 2020;73(6):e20190477 doi: https://doi.org/10.1590/0034-7167-2019-0477

21. Fakhouri AP, Francischetti I, Vieira CM. Educação permanente em saúde: concepções e práticas de facilitadores. Interfaces Educ. 2022;13(37):469-84. doi: https://doi.org/10.26514/inter.v13i37.5012

22. Moisey LL, Pikul J, Keller H, Yeung CYE, Rahman A, Heyland DK, et al. Adequacy of protein and energy intake in critically Ill adults following liberation from mechanical ventilation is dependent on route of nutrition delivery. Nutr Clin Pract. 2021;36(1):201-12. doi: http://doi.org/10.1002/ncp.10558

23. Carrasco V, Freitas MIP, Oliveira-Kumakura ARS, Almeida EWS. Development and validation of an instrument to assess the knowledge of nurses on enteral nutrition. Rev Esc Enferm USP. 2020;54:e03646. doi: https://doi.org/10.1590/S1980-220X2019024003646

24. Oliveira NS, Caruso L, Soriano FG. Enteral nutrition therapy in ICU: longitudinal follow-up. Nutrire Rev [Internet]. 2010 [cited Apr 13, 2025];35(3):133-48. Available from: https://pesquisa.bvsalud.org/portal/resource/pt/lil-577667

25. Castro MG, Pompilio CE, Horie LM, Verotti CC, Waitzberg DL. Education program on medical nutrition and length of stay of critically ill patients. Clin Nutr. 2013;32(6):1061-6. doi: https://dx.doi.org/10.1016/j.clnu.2012.11.023

26. Waele E, Jakubowski JR, Stocker R, Wischmeyer PE. Review of evolution and current status of protein requirements and provision in acute illness and critical care. Clin Nutr. 2021;40(5):2958-73. doi: https://doi.org/10.1016/j.clnu.2020.12.032