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Effect of early enteral nutrition on clinical outcomes in ICU patients: A prospective observational study.

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Abstract
Background
Critically ill patients are at high risk of nutritional inadequacy because of increased metabolic demands, reduced oral intake, and interruptions in feeding. Early enteral nutrition (EEN) is generally recommended when the gastrointestinal tract is functional and feeding is clinically feasible.

Objective
To assess the association between early enteral nutrition and clinical outcomes among critically ill patients admitted to the intensive care unit (ICU).

Methods
A prospective observational study was conducted among **200 adult ICU patients** at RIMS, Ranchi, from January to August 2024. Patients were categorized according to initiation of enteral nutrition as an **early enteral nutrition group (≤48 hours; n=120)** or a **delayed enteral nutrition group (>48 hours; n=80)**. Clinical outcomes including ICU length of stay, duration of mechanical ventilation, infectious complications, feeding intolerance, and ICU mortality were compared between the groups. Categorical variables were analysed using the chi-square test and continuous variables using the independent-samples t-test. A p-value <0.05 was considered statistically significant.

Results
ICU mortality was lower among patients receiving early enteral nutrition than among those receiving delayed nutrition (**15.0% vs 27.5%; χ^2=5.02, p=0.025**). Mean ICU stay was shorter in the early group (**8.6±3.4 vs 10.4±4.1 days; p=0.001**), as was mean duration of mechanical ventilation (**5.7±2.8 vs 7.1±3.2 days; p=0.001**). Infectious complications occurred in **20.8%** of the early group compared with **35.0%** of the delayed group (**χ^2=5.32, p=0.021**). Feeding intolerance was observed more frequently in the early group (**18.3% vs 11.3%; p=0.176**).

Conclusion
In this cohort, initiation of enteral nutrition within 48 hours was associated with lower ICU mortality, shorter ICU stay, shorter mechanical ventilation, and fewer infectious complications. Prospective controlled studies are needed to establish causality.

Keywords: *Early enteral nutrition; critically ill patients; intensive care unit; nutritional support; ICU mortality; mechanical ventilation; infectious complications.*
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1. Introduction
Critically ill patients frequently develop nutritional deficits because of inadequate oral intake, metabolic stress, inflammation, gastrointestinal dysfunction, and interruptions in nutritional therapy. Inadequate nutritional delivery during critical illness may contribute to loss of lean body mass, impaired immune function, delayed recovery, and prolonged hospitalization.

Enteral nutrition is generally preferred when the gastrointestinal tract is functional because it provides nutrients through the physiological route and may help maintain gastrointestinal integrity. The Society of Critical Care Medicine and American Society for Parenteral and Enteral Nutrition recommend initiating enteral nutrition within approximately 24–48 hours after ICU admission when clinically appropriate.[1,2]

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Similarly, the ESPEN guideline on clinical nutrition in the ICU recommends early enteral nutrition in critically ill patients when oral feeding is not possible and enteral feeding is feasible.[3]

The potential clinical benefits of early enteral nutrition include maintenance of gastrointestinal function, reduction in infectious complications, improvement in nutritional adequacy, and possibly shorter duration of organ support and hospitalization. However, the optimal timing and amount of nutritional delivery remain areas of continuing investigation.

Evidence from clinical trials has demonstrated that the relationship between nutritional timing, route, amount, and outcomes is complex. The CALORIES trial, for example, found no significant difference in 30-day mortality between early enteral and parenteral nutritional support, although several secondary outcomes differed.[4] The NUTRIREA-2 trial similarly investigated early enteral versus parenteral nutrition in mechanically ventilated patients with shock, highlighting the importance of patient selection and clinical stability when initiating nutritional therapy.[5]

Observational assessment of early enteral nutrition remains useful because actual clinical practice includes patients with different disease severity, hemodynamic status, nutritional risk, and tolerance to feeding. Therefore, the present study was designed to evaluate the association between initiation of enteral nutrition within 48 hours and important clinical outcomes among ICU patients.

2. Aim and Objectives

Aim

To assess the effect/association of early enteral nutrition on clinical outcomes among critically ill patients admitted to the ICU.

Objectives

1. To determine the proportion of ICU patients receiving enteral nutrition within 48 hours of ICU admission.
2. To compare ICU mortality between patients receiving early and delayed enteral nutrition.
3. To compare ICU length of stay between the two groups.
4. To compare duration of mechanical ventilation.
5. To compare the frequency of infectious complications.
6. To assess feeding intolerance associated with early enteral nutrition.

3. Materials and Methods

3.1 Study Design

Prospective observational study.

3.2 Study Setting

The study was conducted in the ICU of Rajendra Institute of Medical Sciences (RIMS), Ranchi.

3.3 Study Duration

The study period was 8 months, from January 2024 to August 2024.

3.4 Sample Size

A total of 200 adult ICU patients were included.

Sample size calculation

The single-proportion formula was used:

$$n = \frac{Z^2 \times p \times q}{d^2}$$

Where:

- **n** = required sample size
- **Z** = 1.96 at 95% confidence level
- **p** = anticipated prevalence/proportion = 50% (0.50)
- **q** = 1 − p = 0.50
- **d** = absolute precision = 7%

$$n = \frac{(1.96)^2 \times 0.50 \times 0.50}{(0.07)^2}$$

$$n = \frac{3.8416 \times 0.25}{0.0049}$$

$$n = \frac{0.9604}{0.0049}$$

$$n = 196.0$$

The calculated minimum sample size was approximately **196 patients**. For feasibility and to obtain a round sample size, the final sample size was fixed at **200 patients**.

3.5 Study Population

Adult patients admitted to the ICU who were unable to meet their nutritional requirements orally and for whom enteral feeding was considered clinically appropriate.

3.6 Inclusion Criteria

- Age ≥18 years.
- Admission to the ICU during the study period.
- Expected ICU stay ≥48 hours.
- Unable to meet nutritional requirements orally.
- Functional gastrointestinal tract allowing enteral feeding.
- Availability of documented timing of enteral nutrition initiation.

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3.7 Exclusion Criteria

- Patients receiving adequate oral nutrition.
- Patients with absolute contraindications to enteral feeding.
- Patients with gastrointestinal obstruction or perforation.
- Patients transferred from another ICU after initiation of nutritional therapy.
- Patients discharged or deceased before nutritional assessment could be completed.

3.8 Definition of Early Enteral Nutrition

Early enteral nutrition (EEN) was defined as initiation of enteral feeding **within 48 hours of ICU admission**, provided that the patient was clinically suitable for enteral feeding.

Patients in whom enteral feeding was initiated **after 48 hours** were categorized as the delayed enteral nutrition group.

The 24–48-hour initiation window is consistent with major critical-care nutrition guidance.[1,2]

4. Data Collection

Demographic and clinical information was recorded using a structured data collection form.

The following variables were documented:

- Age
- Sex
- Primary diagnosis
- APACHE II score
- Timing of enteral nutrition
- Mechanical ventilation
- ICU length of stay
- Duration of mechanical ventilation
- Infectious complications
- Feeding intolerance
- ICU mortality

Patients were categorized into:

Group A: Early Enteral Nutrition
Enteral nutrition initiated **≤48 hours** after ICU admission.

Group B: Delayed Enteral Nutrition
Enteral nutrition initiated **>48 hours** after ICU admission.

Of the 200 patients:

- **120 (60.0%)** received early enteral nutrition.
- **80 (40.0%)** received delayed enteral nutrition.

5. Statistical Analysis

Categorical variables were presented as frequencies and percentages. Continuous variables were expressed as mean ± standard deviation.

The chi-square test was used to compare categorical outcomes between groups. Continuous variables were compared using the independent-samples t-test.

A **p-value <0.05** was considered statistically significant.

6. Results

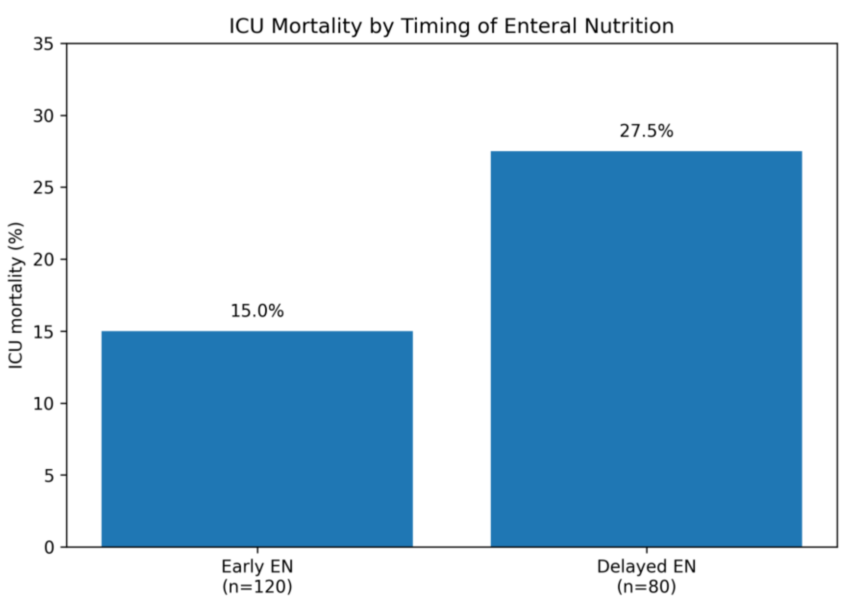

Figure 1 legend: ICU mortality was 15.0% in the early EN group versus 27.5% in the delayed EN group (χ^2=5.02, p=0.025).

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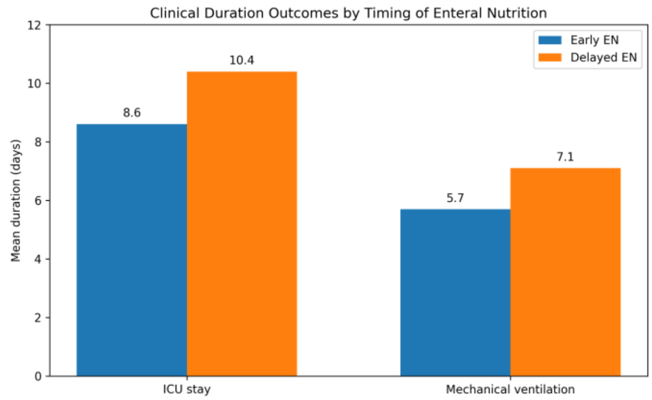

Figure 2 legend: Mean ICU stay and duration of mechanical ventilation were shorter in patients receiving early EN than delayed EN (8.6 vs 10.4 days and 5.7 vs 7.1 days, respectively; p=0.001 for both).

6.1 Distribution of Study Participants

A total of **200 ICU patients** were included.

Group	Number	Percentage
Early EN (≤48 h)	120	60.0%
Delayed EN (>48 h)	80	40.0%
Total	**200**	**100.0%**

6.2 Baseline Characteristics

Characteristic	Early EN (n=120)	Delayed EN (n=80)
Mean age (years)	56.8 ± 15.2	58.1 ± 16.0
Male	73 (60.8%)	48 (60.0%)
Female	47 (39.2%)	32 (40.0%)
Mean APACHE II score	17.4 ± 5.6	18.2 ± 5.9

The baseline characteristics were broadly comparable between the two groups.

6.3 ICU Mortality

ICU mortality	Early EN (n=120)	Delayed EN (n=80)	Total
Death	18 (15.0%)	22 (27.5%)	40
Survival	102 (85.0%)	58 (72.5%)	160
Total	**120**	**80**	**200**

The difference in ICU mortality was statistically significant: ***χ^2 = 5.02, p = 0.025.*** *Thus, mortality was significantly lower in the early EN group.*

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ICU mortality was lower among patients receiving early enteral nutrition.

6.4 ICU Length of Stay

Group	Mean ICU stay
Early EN	8.6 ± 3.4 days
Delayed EN	10.4 ± 4.1 days

*The difference was statistically significant (**t-test, p=0.001**).*

The mean ICU stay was shorter in the early EN group.

6.5 Duration of Mechanical Ventilation

Group	Mean duration of ventilation
Early EN	5.7 ± 2.8 days
Delayed EN	7.1 ± 3.2 days

*The difference was statistically significant (**p=0.001**).*

Among patients requiring mechanical ventilation, the duration was shorter among those receiving early EN.

6.6 Infectious Complications

Infectious complications	Early EN	Delayed EN	Total
Present	25 (20.8%)	28 (35.0%)	53
Absent	95 (79.2%)	52 (65.0%)	147
Total	**120**	**80**	**200**

The difference was statistically significant: $\chi^2 = 5.32, p = 0.021$.

Infectious complications occurred less frequently in the early EN group.

6.7 Feeding Intolerance

Feeding intolerance	Early EN	Delayed EN	Total
Present	22 (18.3%)	9 (11.3%)	31
Absent	98 (81.7%)	71 (88.7%)	169
Total	**120**	**80**	**200**

*Although feeding intolerance was numerically more frequent in the early EN group, the difference was **not statistically significant**:* $\chi^2 = 1.83, p = 0.176$.

Feeding intolerance was defined as clinically documented vomiting, significant abdominal distension, diarrhea, or inability to tolerate prescribed enteral feeding.

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6.8 Summary of Clinical Outcomes

Outcome	Early EN (n=120)	Delayed EN (n=80)	p-value
ICU mortality	15.0%	27.5%	**0.025**
ICU stay	8.6 ± 3.4 days	10.4 ± 4.1 days	**0.001**
Mechanical ventilation	5.7 ± 2.8 days	7.1 ± 3.2 days	**0.001**
Infectious complications	20.8%	35.0%	**0.021**
Feeding intolerance	18.3%	11.3%	0.176

Overall, early EN was associated with better clinical outcomes in this cohort, particularly with respect to mortality, ICU length of stay, duration of mechanical ventilation, and infectious complications.

7.Discussion

The present prospective observational study evaluated the association between early enteral nutrition and clinical outcomes among 200 critically ill patients. Sixty percent of patients received enteral nutrition within 48 hours of ICU admission, while 40% received it after 48 hours.

The principal finding was that ICU mortality was significantly lower in patients receiving early EN than in those receiving delayed EN (15.0% vs 27.5%; $\chi^2=5.02$, p=0.025). This finding is consistent with the rationale underlying contemporary ICU nutrition guidelines, which encourage early enteral feeding when clinically feasible.[1–3]

However, the broader literature indicates that the effect of nutritional timing on mortality is not uniformly demonstrated. Trials comparing nutritional strategies have produced mixed results, emphasizing that patient selection, illness severity, hemodynamic stability, nutritional dose, and route of administration all influence outcomes. For example, the CALORIES trial found no significant difference in 30-day mortality between early enteral and parenteral nutrition.[4]

In the present study, patients receiving early EN had a significantly shorter ICU stay (8.6 vs 10.4 days, p=0.001). They also had a shorter duration of mechanical ventilation (5.7 vs 7.1 days, p=0.001). These findings suggest that early provision of enteral nutrition may be associated with improved clinical recovery, although an observational design cannot establish that early feeding itself caused these improvements.

Infectious complications occurred in 20.8% of the early EN group compared with 35.0% of the delayed group ($\chi^2=5.32$, p=0.021). Maintenance of gastrointestinal integrity and provision of nutrients through the enteral route have been proposed as potential mechanisms underlying beneficial effects of enteral nutrition. However, clinical evidence regarding the magnitude of infection reduction varies among studies.

A meta-analysis evaluating different levels of initial calorie intake in critically ill patients found no significant difference in mortality or infection between lower- and higher-energy strategies, illustrating that the amount of nutrition delivered may be as important as timing.[6]

Feeding intolerance was observed more frequently in the early EN group (18.3% vs 11.3%), although the difference was not statistically significant (p=0.176). This observation is clinically relevant because critically ill patients may experience delayed gastric emptying, ileus, abdominal distension, vomiting, and diarrhea. The risk of gastrointestinal intolerance should therefore be considered when initiating and advancing enteral feeding.

The ASPEN/SCCM guidelines recommend beginning enteral nutrition within 24–48 hours in appropriate critically ill patients and gradually advancing toward nutritional goals while considering tolerance and clinical condition.[1,2] The ESPEN guideline similarly supports early enteral nutrition when oral feeding is not possible and enteral nutrition is feasible.[3]

The results should therefore be interpreted as an association rather than a causal effect. Patients receiving early EN may have been clinically more stable, had fewer contraindications to feeding, or had lower illness severity than patients whose feeding was delayed. Although baseline APACHE II scores were broadly comparable in this dataset, residual confounding cannot be excluded.

8.Limitations

The study has several limitations. It was conducted at a single centre, which may limit generalizability. Because the study was observational, the association between early enteral nutrition and improved outcomes cannot establish causality, and residual confounding by disease severity, hemodynamic status, diagnosis, nutritional risk, and clinical decision-making may remain. The timing of EN may also have been influenced by the patient's underlying condition. Nutritional adequacy, caloric and protein delivery, interruptions in feeding, and exact formula composition were not comprehensively evaluated. The relatively small sample size may also limit the precision of estimates.

9.Conclusion

In this prospective observational study of 200 ICU patients, initiation of enteral nutrition within 48 hours was associated with significantly lower ICU mortality, shorter ICU stay, shorter duration of mechanical ventilation, and fewer infectious complications compared with delayed initiation. Feeding intolerance was numerically higher in the early EN group but was not statistically significant.

Early enteral nutrition may therefore be an important component of nutritional management in appropriately selected critically ill patients. However, because this is an observational design, these findings should be interpreted as associations, and larger prospective controlled studies are required to establish causality.

Source of funding

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Conflict of interest

No Conflict of interest.

10.References

1. McClave SA, Taylor BE, Martindale RG, Warren MM, Johnson DR, Braunschweig C, et al. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.). JPEN J Parenter Enteral Nutr. 2016;40(2):159-211. https://doi.org/10.1177/0148607115621863
2. Taylor BE, McClave SA, Martindale RG, Warren MM, Johnson DR, Braunschweig C, et al. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient. Crit Care Med. 2016;44(2):390-438. https://doi.org/10.1097/CCM.0000000000001525
3. Singer P, Blaser AR, Berger MM, Alhazzani W, Calder PC, Casaer MP, et al. ESPEN guideline on clinical nutrition in the intensive care unit. Clin Nutr. 2019;38(1):48-79. https://doi.org/10.1016/j.clnu.2018.08.037
4. Harvey SE, Parrott F, Harrison DA, Bear DE, Segaran E, Beale R, et al. Trial of the route of early nutritional support in critically ill adults. N Engl J Med. 2014;371(18):1673-84. https://doi.org/10.1056/NEJMoa1409860
5. Reignier J, Boisramé-Helms J, Brisard L, Lascarrou JB, Hantala F, Anguel N, et al. Enteral versus parenteral early nutrition in ventilated adults with shock: a randomised, controlled, multicentre, open-label, parallel-group study (NUTRIREA-2). Lancet. 2018;391(10116):133-43. https://doi.org/10.1016/S0140-6736(17)32146-3
6. Elke G, Wang M, Weiler N, Day AG, Heyland DK. Close to recommended caloric and protein intake by enteral or parenteral nutrition is associated with better clinical outcomes in critically ill patients: secondary analysis of a multinational, observational study. Crit Care. 2014;18(5):R140. https://doi.org/10.1186/cc13720
7. Doig GS, Heighes PT, Simpson F, Sweetman EA, Davies AR. Early enteral nutrition, provided within 24 h of injury or intensive care unit admission, significantly reduces mortality in critically ill patients: a meta-analysis of randomised controlled trials. Intensive Care Med. 2009;35(12):2018-27. https://doi.org/10.1007/s00134-009-1664-4
8. Casaer MP, Mesotten D, Hermans G, Wouters PJ, Schetz M, Meyfroidt G, et al. Early versus late parenteral nutrition in critically ill adults. N Engl J Med. 2011;365(6):506-17. https://doi.org/10.1056/NEJMoa1102662
9. Harvey SE, Parrott F, Harrison DA, Bear DE, Segaran E, Beale R, et al. A multicentre, randomised controlled trial comparing the clinical effectiveness and cost-effectiveness of early nutritional support via the parenteral versus the enteral route in critically ill patients (CALORIES). Health Technol Assess. 2016;20(28):1-144. https://doi.org/10.3310/hta20280
10. Arabi YM, Aldawood AS, Haddad SH, Al-Dorzi HM, Tamim HM, Jones G, et al. Permissive underfeeding or standard enteral feeding in critically ill adults. N Engl J Med. 2015;372(25):2398-408. https://doi.org/10.1056/NEJMoa1502826
11. Rice TW, Wheeler AP, Thompson BT, Steingrub J, Hite RD, Moss M, et al. Initial trophic vs full enteral feeding in patients with acute lung injury: the EDEN randomized trial. JAMA. 2012;307(8):795-803. doi:10.1001/jama.2012.137. https://doi.org/10.1001/jama.2012.137
12. Petros S, Engelmann L. Enteral nutrition delivery and energy expenditure in critically ill patients. Clin Nutr. 2006;25(1):51-8. https://doi.org/10.1016/j.clnu.2005.08.013
13. Elke G, van Zanten ARH, Lemieux M, McCall M, Jeejeebhoy KN, Kott M, et al. Enteral versus parenteral nutrition in critically ill patients: an updated systematic review and meta-analysis of randomized controlled trials. Crit Care.

2016;20:117. https://doi.org/10.1186/s13054-016-1298-1

14. Elke G, Hartl WH, Kreymann KG, Avenell A, Ebner C, Frühwald S, et al. Clinical nutrition in intensive care medicine. Crit Care. 2019;23:35.
15. Marik PE, Zaloga GP. Early enteral nutrition in acutely ill patients: a systematic review. Crit Care Med. 2001;29(12):2264-70. https://doi.org/10.1097/00003246-200112000-00005
16. Doig GS, Simpson F, Heighes PT, Bellomo R, Chesher D, Caterson ID, et al. Restricted versus continued standard caloric intake during the management of refeeding syndrome in critically ill adults: a randomised, parallel-group, multicentre, single-blind controlled trial. Lancet Respir Med. 2015;3(12):943-52. https://doi.org/10.1016/S2213-2600(15)00418-X

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