

Early Enteral Nutrition Met Calories Goals Led by Nurse on Improve Clinical Outcome: A Systematic Scoping Review

Abstract

Background: Critically ill patients face challenges in hypercatabolism due to crisis states, as it may lead to malnutrition. An early Enteral Nutrition (EN) within 24–48 h is recommended to use in order to improve clinical outcomes. This systematic scoping review is examined recently with the evidence of the early EN protocol led by nurses to drive and achieve the daily calorie target and improve clinical outcomes. **Materials and Methods:** The database of CINAHL, MEDLINE via PubMed and Scopus, Web of Science, and Embase through Ovid from January 2019 to September 2020, comprised of 221 articles which four articles are chosen and entered into the final analysis. **Results:** The findings show the benefits of the early EN to guide nurses to start the EN as soon as possible after admitted to the Intensive Care Unit or when hemodynamic is stable in order to achieve a daily calorie target regarding the reduced hospitalization, duration of mechanical ventilation, morbidity, and mortality. **Conclusions:** The synthesized results show the early EN led by a nurse to address the specific needs and the vital role of nutritional support, and also drive the enteral feeding for critically ill patients to reach the calorie target goals in short times to enhance clinical outcomes.

Keywords: Critical illness, enteral nutrition, nurses

Introduction

Critically ill patients having a life-threatening condition and requirements for advanced treatment also face challenges of hypermetabolic and hypercatabolic, which may affect to body mass and malnutrition. Malnutrition in critically ill patients is widely accepted that it is a major problem. Approximately 40% of critically ill patients have malnutrition,^[1] and 70% of malnutrition derived when staying in the hospital.^[2] The causes of malnutrition are delayed Enteral Nutrition (EN) and inadequate amount of calories target.^[3] These problems may directly affect the prolonged recovery,^[4,5] hospitalization,^[6,7] and mortality rate.^[1,2] Nevertheless, malnutrition is also led to weakness or atrophy of the diaphragm in the inflammation process of critical crisis state.^[8,9] Consequently, a meta-analysis shows the early EN within 24–48 h after Intensive Care Unit (ICU) admission met the recommended adequate daily target calories, which it may enhance the clinical outcomes and reduce several complications.^[10-12] EN has several

advantages such as to prevent gut ischemia, to maintain intestinal function and bacteria transmission, and to promote the immune system.^[4,13] The nurse plays a vital role working with a critically ill patient and a significant role in EN management.^[14]

A nurse who starts enteral feeding, manages, and prevents EN complications has the obstacle in working. In addition, the effectiveness of EN protocol is quite unclear about when and how to start, also lacking of EN management.^[14,15] Therefore, the limited information about early EN protocol by nurses need to be clarified and ensured the important role of nurse managers in EN.^[7] Jamshidi *et al.*^[16] found that ICU nurses do not know how to prepare and preserve the EN, also most of ICU nurses do not have a good enteral feeding knowledge leading to an inadequate calorie and protein intake. Particularly, a few previous studies in nurse-led EN management have been discussed as apart from nursing practice in critical care and associated with promoting achieved energy and protein requirements and improve clinical outcomes. Marshall

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et al.^[17] showed that nurse who provides the closet care for critically ill patients also has a vital role in nutritional care, for example, nutrition assessment, prefeeding readiness assessment, and the execution of EN.

Therefore, these reviews are conducted by synthesizing the systematic scoping review and identifying the recently empirical evidence of early EN protocols on improving clinical outcomes. The scoping systematic review focuses on early EN within 24–48 h leading to achieve the target calories requirements within the first 5d as recommended.^[11,12,14,18,19] It also improves the clinical outcomes such as reduced infection, hospitalization, duration of ventilator mechanical, morbidity, and mortality in critically ill patients.^[2,11,12,14,19] However, the early EN protocol is quite unclear in the nurses' role and insufficient evidence of nurses' knowledge regarding to EN management. This review will identify and synthesize the recently published studies investigating the EN protocol driven by nurse-led in order to improve clinical outcomes. The purposes of this systematic scoping review are to identify and synthesize the recent evidence base practice of the early EN within 24–48 h which met the adequate calories target for critically ill patients to improve clinical outcomes. This scoping review is to address the gap evidence of the implementation of the early EN to enhance the nurses' knowledge about EN management. The current review aims to examine the recent evidence of the early EN protocol led by nurses to drive and achieve the daily calorie target and improve clinical outcomes.

Materials and Methods

This study is conducted by a systematic scoping review to map the literature on an implementation of early EN within 24–48 h protocol driven by nurses among critically ill patients. It also identifies the key findings and emerges themes that may improve clinical outcomes. The study reports the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) statement. Four electronic bibliographic databases – Cumulative Index to Nursing and Allied Health Literature (CINAHL complete) and MEDLINE via PubMed and Scopus, Web of Science, and Embase through Ovid are used to find the empirical studies of nurse-led program published within the last 10 years. Scoping search will indicate the sufficient protocol on early EN within 24–48 h among critically ill patients; the available studies using this design are included. The searching is limited to study the published evidence between 2010 and 2020, no language restrictions and populations are adults. The initial search is conducted by January 2019 and a confirmation search is completed in September 2020. Studies will be selected if it meets the following inclusion criteria: (a) examine early EN within 24–48 h, (b) identify nurse as a main of provider, (c) critically ill patients, (d) use

Randomized-Controlled Trials (RCT), quasi-RCTs, and Controlled Before and After studies (CBA) of early EN protocol, and (e) original research articles. It also uses PICO (patients, intervention, context, outcomes) format adopted for this review which includes the following definitions: Patients: Medically and surgically critically ill adult patients. Intervention: Early EN protocol within 24–48 h. Comparison: Usual care. Outcomes: Improvement in participants' clinical outcomes such as reduced hospitalization, duration of ventilation mechanical, cost of healthcare, morbidity, and mortality.

As it is outlined by the Cochrane Handbook for Systematic Reviews of Interventions, The Mapping Medical Subject Heading (MeSH) terms are consistent with the aim of this study which used for the initial search strategy. The MeSH terms and Keywords are identified for each electronic database for relevant studies. Specific journals and reference lists of previous studies are also examined. Search terms are “Critically ill patients,” “early enteral feeding,” “protocol,” and “clinical outcome.” The outcomes from retrieved studies report two main outcomes of early enteral feeding: (1) primary outcomes as improved clinical outcomes in terms of reduce hospitalization, duration of mechanical ventilators, and mortality and (2) ensuring nurses' understanding of EN management.

A PRISMA flowchart of the study screening and the selection process from the four electronic databases with a total of 221 articles are retrieved. All articles are imported to a RefWorks database and duplicated data are removed. The remaining 221 articles are evaluated by title: 122 articles are excluded, 74 articles are then evaluated by abstract, 25 of which are identified for full-text review, 21 articles are excluded based on the exclusion criteria of this review, and 4 empirical studies are selected for quality assessment [Tables 1-3]. In this process, the first author conducts the study selection and the second author reviews and confirms the study selection process [Figure 1].

Ethical considerations

In writing the manuscript, to avoid plagiarism and data fabrication are considered. The results of the analysis are honest. The study is to review the literature, and it does not involve human participants. This study is approved by the Research Ethics Committee on Human, Suan Sunandha Rajabhat University (COA. 18-043-1-3).

Results

Overview of studies

The studies show that the early EN has a positive influence on clinical practice and clinical outcomes. Therefore, the theme emerged in this study is discussed and involved with two key outcomes that are recommended for the implementation of guidelines. Five studies are used to analyze the outcomes of early EN protocol within 24–48 h and particularly led by a nurse in this

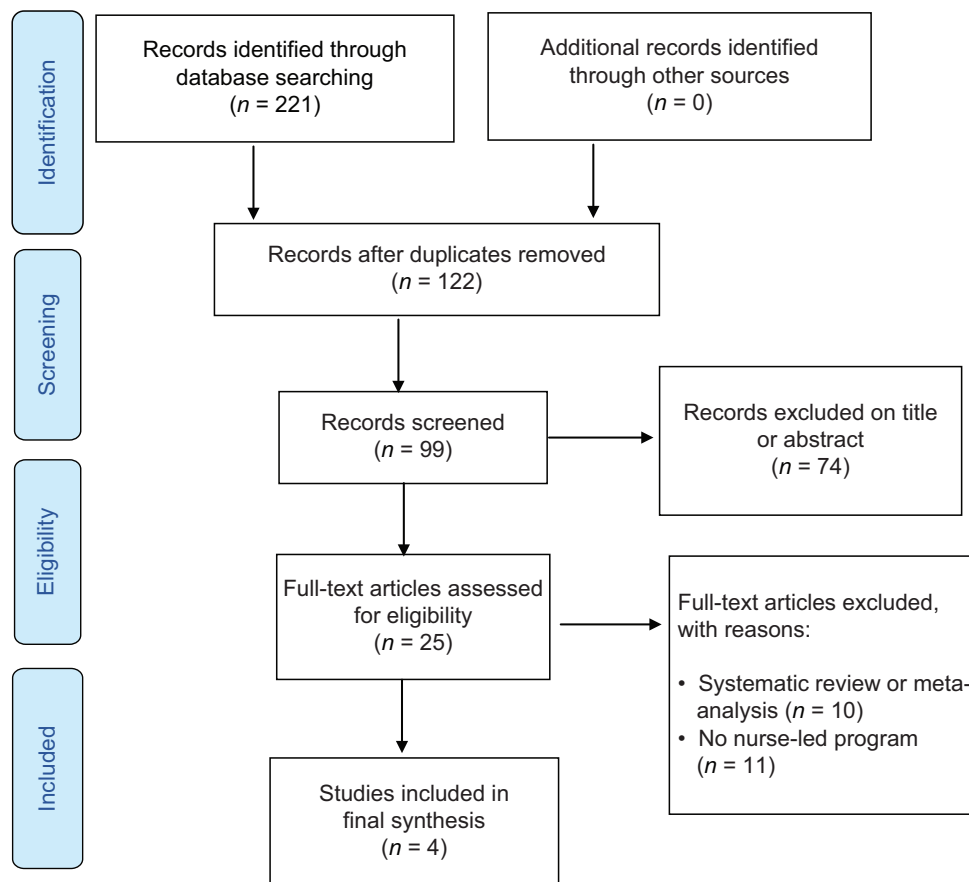


Figure 1: PRISMA flowchart of the screening and selection process

systematic scoping review.^[7,8,14,15,20] The designs include: a quasiexperimental ($n = 2$) and a retrospective study with prospectively ($n = 3$). The study population includes adults with age over 18 years old, critically ill patients who are admitted in ICU and use mechanical ventilators, also stability of a vital sign and hemodynamic. The studies are conducted in Thailand ($n = 1$), Israel ($n = 1$), Turkey ($n = 1$), Germany ($n = 1$), and Korea ($n = 1$). All of these studies are published between 2010 and 2020 or 10 years ($n = 5$). However, the total number of study participants are 221, the sample size is ranged from 40 to 270, and five studies report the power analysis for sampling as well.

Outcomes of early enteral nutrition led by nurses

All current retrieved studies are categorized into two domains: primary outcomes that are improved clinical outcomes including deceased duration of mechanical ventilators, hospitalization, and mortality and secondary outcome which is the EN protocol ensuring nurses' understanding of EN management.

Primary outcomes: Early initial enteral nutrition within 24–48 h vs improve clinical outcomes

Mortality

Based on the finding of previous publications, the results show the benefits of early EN within 24–48 h, which are

recommended and led by nurses. The literature research findings within 24–48 h has several benefits for critically ill patients in terms of decreasing the inflammatory process as a crisis state of critically ill patients and reducing mortality rate.^[20] Previous studies reveal that starting EN within 52.3 h can reduce mortality rate in hospital (45% vs 27%). However, two studies show that the recommended early EN within 24–48 h are not differ in mortality at before and after implementation of the protocol.^[6]

Duration of mechanical ventilation

Two eligible studies show that the early EN provided by nurse-led protocols are presented in a shorter duration of mechanical ventilators. Koontalay A (2020)^[14] demonstrated that the early EN following the protocol that the nurses provide the initial EN protocol within 8.67 h is quicker than the control group (24 h) and it significantly decreases the duration of mechanical ventilators when compared with the usual care (78.45 h vs 33.90 h). However, Orinovskiy and Raizman (2018)^[20] showed that after the implementation of protocol, there is no significant difference in the duration of mechanical ventilators.

Hospitalization

Three studies are included in the systematic scoping reviews; it reports that EN within 24–48 h can reduce

Table 1: Characteristics of the studies

Author, Year	Study Design	Sample and Setting	Result on Protocol Implementation	Key Findings	Limitation
Koontalay <i>et al.</i> , 2020 ^[14]	A quasi-experimental	44 critically ill patients in ICU, Thailand Duration 6 months	44 critically ill patients are divided into two equal groups which are the control group received usual care and intervention groups used Enteral Nutrition(EN) protocol by nurse to start EN within 24-48 h and checklist daily calories target requirement assessed with 7 d. The EN initial within 8.67 h (24 vs 8.63) and achievement daily calories target in 7d is 4,591 kcal/kg/day (2,481 vs 6,700). The duration of mechanical ventilation is 33.90 h (78.45 vs 33.90)	The intervention reaches EN within 12 h and achieves the daily calories target within first 7 day that reduces duration of mechanical ventilator	A small of sample size and a single setting that might not be generalized of the result finding
Sungur <i>et al.</i> , 2015 ^[6]	A quasi-experimental	40 critically ill patients Duration 6 months	40 critically ill patients are divided into two groups as equal. It is compared between historical group received usual care and the intervention group used the nutrition protocol and consumed on the first, second, and third day. Most groups start within the first day and meet calories target within the third day	The findings found that the energy requirement and protein consumption is lower in historical group causes pausing nutrition support while treatment activities. Using nutrition support protocol to achieve the energy and protein requirements is started to feed within 24-48 h. It also decreases hospitalization, but no differ in mortality rate	A small of sample size might not be generalized of the result finding
Friesecke <i>et al.</i> , 2014 ^[15]	Retrospectively and prospective, before-and-after design	101 and 97 critical ill patients are included, ICU, Germany Duration 12 months	101 critically ill patients are before implementation and 97 are after the intervention; the intervention is provided by nurse. Time to start the EN is shorter than before as without protocol (47 vs 28). More than half of participants are started EN within 24 h (63.9%). In addition, the number of calories target is significantly higher than before. ICU nor differ in mortality between both groups ($p=0.375$)	Early EN within 24 h led to receive more calories within first 5d of ICU. The EN reduces the time to start and increase the amount of calories target in order to improve enteral nutrition. EN protocol can enhance the confidence of nursing team to be able to decide when they should start EN	The retrospective data sometime may introduce bias
Orinovsky and Raizman, 2018 ^[20]	Retrospective for patients in 12 months before and 12 months after implementation of the protocol	65 before and 52 after applied the protocol, Critically ill Duration 24 months	The implementation of nurse-led EN feeding for retrospective 12 months before and 12 months after implantation of the protocol. The findings is earlier time after implantation of protocols EN (70.3 vs 52.3), enhance calories target goals within 96 h (22 vs 47)	The protocol implemented by nurse guiding them to understand the EN management and safety for patients The finding is a significant different after implementation the protocol, more patients achieve their calories target within a shorter time after admission in ICU. However, no different of hospitalization (38.3 vs 29.3) and duration of ventilator (21.7 vs 20.8) but indicates decrease in mortality (45 vs 27)	A small size of participant and retrospective data in the intervention is smaller and it is in a single unit

EN = enteral nutrition

hospitalization in ICU and hospital. Despite two studies found that the early EN within 24–48 h is the recommended average, 36 h duration has no significant difference between before and after implementing

the protocol.^[20] Sungur *et al.* (2015)^[6] showed that the protocol can enhance achievement, starting to feed within 24 h is associated with the decreased hospitalization.

Table 2: Summary of clinical outcomes

Study	Country	Outcomes (tool)	Mortality	Hospitalizations (days)	Duration of mechanical ventilation (hours)	Initial enteral nutrition (hours)	Calories target goals within first 5 d
Koontalay <i>et al.</i> (2020) ^[14]	Thailand	APCHE II*			78.45 vs 33.90		2,481 kcal/kg/d vs 6,700 kcal/kg/d
Friesecke <i>et al.</i> (2014) ^[6]	Germany	SAPS II **	66.3% vs 72.2%			47 (34) vs 28 (20)	208 (293) vs 768 (681)
Sungur <i>et al.</i> (2015) ^[15]	Turkey		70% vs 75%	19.40 (15.94) vs 16.15 (9.93)			1,551 (55.7) vs 1,715 (67.3)
Orinovsky <i>et al.</i> (2018) ^[20]	Israel	APCHE II	45% vs 27%	38.3 vs 29.3	21.70 d vs 20.8 0	70.3 vs 52.3	175.5 h vs 73.2 h

* APCHE II =The Acute Physiology and Chronic Health Evaluation II, **SAPS II =Simplified Acute Physiology Score II

Table 3: Complication after implementation of the enteral nutrition (EN) protocols

Study	Complications	Before (%)	After (%)
Koontalay <i>et al.</i> (2020) ^[14]	not detected		
Friesecke <i>et al.</i> (2014) ^[6]	not detected		
Sungur <i>et al.</i> (2015) ^[15]	diarrheal increase in gastric residual volume (GRV)	were detected were detected	were detected were detected
Orinovsky <i>et al.</i> (2018) ^[20]	intolerance	9%	3%

Secondary outcomes: Enteral nutrition protocol ensures nurses’ understanding of enteral nutrition management

The EN protocol can encourage the early initial EN for critically ill patients and provide standardized information to ICU nurses. It also supports a special training of the ICU nursing teams who are responsible to decide when to start EN when there are no contraindications to confirm nurse-initiation feeding as soon as possible. An effective strategy is to improve the delivery of EN and to achieve daily calories target in order to improve clinical outcomes for critically ill patients. For example, contraindication includes bowel obstruction, severe ileus, massive upper gastrointestinal bleeding, severe vomiting or diarrheal, gastrointestinal fistula.^[15,6,7,14,20] Although all protocols are recommended, the nurses should provide the EN within 24–48 h after ICU admission.^[4,21,22] The assessment for readiness before starting EN is as follows: (a) hemodynamic stable for at least 6 h or fully resuscitated (HR 120 BPM, MAP ≥65 mmHg), (b) holding inotropic agents such as dopamine should be low dose ≤3 µg/kg/min or norepinephrine ≤100 µg/kg/min, (c) base value over -2.5 mEq/L or lactate level less than 2.5 mmol/L (Khalid *et al.*, 2010), and (d) gastric residual volume (GRV) threshold 250 mL; high GRV is provided for pro-kinetic agents.^[6,14,15,17,20,23-25] Goal rates are set by the physician or dietitian 25–30 kcal/kg per day. In addition, the nurses should provide tube insertion and placement

confirmation of the tube every 4 h. Nurse’s prevention and management of complications such as patients receive the prokinetic agent if GRV is higher than 500 mL or prevent the aspiration pneumonia to adjust the head position 30 degrees.^[13,14,18,20,21] Nurse has a potential role to improve nutrition practice to ensure that patients will meet the daily calories target as current studies show the critically ill received EN within 24–48 h should meet adequate energy requirements within the first 5 days after ICU admission to promote nutritional status and respiratory muscle function. It also reduces mechanically ventilators days,^[13,14,20,22-24] hospitalization,^[20] and mortality.^[8]

Discussion

This systematic scoping reviews synthesize the experimental studies to determine the optimal early EN led by a nurse for critically ill patients with various types of diagnosis such as septic shock, respiratory disease, cardiovascular disease, gastrointestinal disease, neurological disease. Those current studies are published from 2010 to 2020. In these recent studies, there are a few published studies conducted in critically ill patients, particularly these patient groups are severe illness and unpredictable of prognosis. The outcome measure is heterogeneous, so these results could not be conducted with the meta-analysis of the study results. These results are consistent with clinical outcomes including duration of mechanical ventilators, hospitalization, and mortality and nurses’ knowledge as well.^[17]

As four studies implementation are led by nurses and coordinated with a multidisciplinary team, it provides and achieves better outcomes; the nurses conduct the main role of EN interventions, also enable advocacy, education, readiness, and management of the EN in order to encourage delivery of EN as prescribed the best practice of EN management. The nurses and the multidisciplinary team believe that the quality of protocol is safer and more confident in the implementation. Additionally, the protocols for EN can enhance ICU nurses’ performance assessments frequently and correctly before feeding,^[6,7,13,14] it also promptly treats the signs and symptoms of gastrointestinal disorders from EN such as vomiting,

diarrhea, or GI intolerance and avoid discontinuation of EN.^[6,25] The protocols provide the guidelines, standard for EN management, and evaluation after feeding to be the benefits for nurses. They could manage time for other nursing procedures as well as promote compliance for using protocol and improve healthcare services.

Koontalay *et al.* (2020)^[14] stated that the protocol guideline used in daily practice led by ICU nurse to manage time to start EN should be initially within 8.63 h to achieve the number of calories' target requirements within the first 7 days after ICU admission (2,481 vs 6,700). ASPEN recommends^[2,11] that a shorter length of mechanical ventilator (78.45 h vs 33.9 h) depends on the patients with a ventilator who need a higher target calorie daily requirements than other patients. Contrast, Orinovsky and RaizMan (2018)^[20] found that implementing EN protocol does not have an impact on the duration of mechanical ventilation (21.7 d vs 20.8 d) as it is a barrier to meet the goals of adequate provision of EN in ICU, such as GI disorders, interrupted of feeding, and the barrier about the timely initiation. This study starts EN within 96 h (22% vs 47%). After implantation of the protocol, more patients achieved = calorie target in a shorter time within the first 3 days after ICU admission (175.5 h vs 73.2 h). It decreases the discontinued intolerance (9% vs 3%) and there is no adverse detected.

Orinovsky and Raizman (2018)^[20] showed that after protocol implantation, the mortality rate decreases (45% vs 27%), but there is no difference in hospitalization. However, Sungur *et al.* (2015)^[6] found that most of participants received the EN within 24 h after implementation of protocol, showing the prescribed energy requirements on the first, second, and third of ICU admission are as follows 38% vs 62%, 56.5% vs 68.5%, and 60% vs 63%. It is significantly different, but it is not significantly different in hospitalization.^[23]

All five studies found that early EN can lead optimal EN management as it is driven by nurses to improve nursing procedures and reach the daily energy requirements.^[2,11,12,14,19] Critically ill patients have been decreased energy and stored protein due to hypercatabolism and hypermetabolism. The crisis state may lead to malnutrition, delay recovery, tendency infections, and induce multiple organs failure.^[24,25] Therefore, summary of the recent studies could enhance the nurses and staffs to ensure that they start EN within 24 h or as soon as possible after ICU admission or stable hemodynamic in order to reach caloric target requirements each day.^[2,7,11,12,14-17,19,21] As a result, the implementation of early EN protocol can benefit the restoration of organs and improve intestinal circulation and absorption as their respiratory function would increase the ability to wean mechanical ventilation and reduce hospitalization and mortality.^[21-25] There are several limitations; the first limitation is the sample size of

current studies, and the findings might not generalization. A limited number of published studies focusing on the nurse-driving EN and a description of the potential of clinical outcomes are found. Therefore, the finding might be beneficial for the nurses and healthcare professionals to implement and develop the guidelines for EN protocols, which driven by nurses to improve nutrition status and clinical outcomes to reduce the duration of mechanical ventilation, morbidity, and mortality.

Conclusion

This systematic scoping reviews found that the ICU nurse face challenges on the initiation of EN due to the lack of knowledge and understanding of EN. However, the protocols can encourage the nurses to continue and comply with the standard guideline, also cooperate with a multidisciplinary team to confirm the timing to start enteral feeding. The protocols help the nurses to implement the procedure to have much more confident in terms of readiness before feeding, assessment energy requirements each day, tube management, and prevention of the complication from enteral feeding. Consequently, after implementation of protocols, it shows that critically ill patients can achieve caloric target goals within 7 days that is earlier starting with EN as recommended within 24–48 h to reduce the number of hospitalizations, duration of mechanical ventilation, and mortality.

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Conflicts of interest

Nothing to declare.

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