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# Knowledge, attitude, and practice of nurses regarding enteral feeding: a systematic review

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## Abstract

**Background** Enteral feeding uses feeding tubes for liquid food administration. Enteral feeding maintains gastrointestinal function but has complications like aspiration, diarrhea, and constipation. To avoid complications, nurses in intensive care units must have proper knowledge, attitude, and practice towards enteral feeding.

**Method** A systematic review was conducted. The search was restricted to January 2000 to April 2024, encompassing scientific journals accessible via the following online databases: PubMed (including Medline), Cochrane Library, Scopus, Web of Science, and Embase. Google Scholar was searched comprehensively to include all relevant studies. The search strategy employed the following keywords and medical subject headings: [knowledge OR attitude] AND [enteral feeding OR enteral nutrition] AND nurs\*. Only cross-sectional studies were included in this systematic review. Two authors independently conducted the selection of eligible studies, data extraction, and risk of bias assessment. Due to the discrepancies in methodologies and research goals among the investigated studies, a narrative synthesis was conducted.

**Results** In total, there were 3187 articles found in the initial search across five online electronic databases. Finally, a thorough review was conducted, incorporating 22 studies. Based on the studies analyzed in this systematic review, nurses showed a positive attitude toward enteral feeding; there was a necessity to enhance their knowledge and practice. Continuous education combined with interdisciplinary collaboration can significantly improve nurses' knowledge and practice of enteral feeding.

**Conclusion** Many studies highlight the necessity of enhancing the knowledge and practice of nurses in this area. Implementing educational interventions has positively impacted nurses' knowledge and performance.

**Keywords** Knowledge, Attitude, Practice, Enteral Nutrition, Enteral Feeding, Nurse

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## Introduction

Malnutrition is a prevalent and debilitating condition commonly observed in hospital settings, with a global prevalence ranging from 13 to 69% [1]. Nutrition is crucial in various care departments, including intensive care units (ICU). Approximately 40% of patients admitted to ICU suffer from malnutrition, resulting in a prolonged treatment and recovery period compared to non-malnourished patients [2]. As a result, malnutrition is connected to an extended period of hospitalization, an elevated risk of acquiring infections during hospitalization, a poor prognosis, and higher mortality rates [1–6].

Among the various approaches to mitigate malnutrition and its complications in patients with oral feeding difficulties, enteral feeding (EF) stands out as the predominant method for nutritional support [6]. EF involves administering liquid food via feeding tubes such as nasoduodenal, nasogastric, jejunostomy, and gastrojejunostomy [4–6]. This can be done continuously, intermittently, or as a bolus [2]. While EF has been shown to maintain gastrointestinal function and expedite hospital discharge in ICU, it carries the risk of complications, including aspiration, diarrhea, nausea, vomiting, flatulence, constipation, tubal dislocation, tubal obstruction, stoma infection and refeeding syndrome [2–6]. Therefore, to prevent the complications of EF and its continuation, nurses, especially ICU nurses, are required to have an adequate level of knowledge and attitude toward the methods and process of EF, the digestive system, diagnosis of malnutrition, the position of the body during feeding, the correct use of nutrients, monitoring the storage conditions of nutritional solutions and ostomy care [1, 2, 4–6].

The findings of various studies highlight the significant role of ICU nurses in facilitating early EF and minimizing the risk of complications [7–9]. In ICU, where EF is widely utilized, previous studies emphasize the need to ascertain nurses' level of knowledge in providing high-quality nursing care [2, 3, 10]. Several barriers have been identified that impact clinical practice regarding nutrition provision. These include patient resistance to change, nurses' limited experience with ICU patients, lack of awareness regarding nutritional protocols, and inadequate EF education [1, 2, 6]. Therefore, considering the high prevalence of EF usage in patients, the critical role of nurses, and the impact of knowledge and attitude of nurses on the clinical outcomes of patients, we decided to conduct a systematic review to investigate the knowledge, attitude, and practice of nurses toward EF.

## Method

### Design

Due to variations in methodologies and objectives among the studies meeting the inclusion criteria, we opted for a

systematic review without meta-analysis. The systematic review was informed by applying the Preferred Reporting Items Systematic Reviews and Meta-analysis (PRISMA) Statement [11]. The study was conducted according to a predefined protocol by the researchers, but the protocol was not registered or published due to time constraints. The protocol followed the guidelines of the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocol (PRISMA-P) [12].

### Search methods

The search keywords were determined through team discussions, conducting a pilot search across general and specialized databases, and consulting with a librarian. The search was limited to January 2000 to April 2024 in scientific journals available through the following online databases: PubMed (including Medline), Cochrane Library, Scopus, Web of Science, and Embase. A comprehensive search was conducted on Google Scholar to include all relevant studies. A meticulous examination was carried out on the complete inventory of reference lists derived from the studies included in the systematic review. The following keywords and medical subject headings were used as the search strategy: [knowledge OR attitude] AND [enteral feeding OR enteral nutrition] AND nurs\*. The whole search syntax of all database searches is presented in supplementary materials Table S1.

### Search outcome and data extraction

Each step of the systematic review was carried out independently by the authors (A.Z., S.S., and A.N.), who maintained frequent online discussions and reached collective agreements on the course of action for each review step. Unpublished dissertations and policy documents, categorized as grey literature, underwent evaluation to enhance the comprehensiveness of the search. Whenever necessary, the specialist offered guidance and support during the search process. A single author, A.Z., reviewed the titles and abstracts of the studies obtained during the search process. The final studies were retrieved through the independent evaluation of full texts by two authors, A.Z and A.E. When disagreements arose regarding the inclusion of selected studies, discussions were conducted until a consensus was achieved.

Data collection involved utilizing a data extraction table to gather information about study characteristics. The table encompassed various elements, including the author's name, publication year, country, design, sample size, setting, and information about knowledge, attitude, and practice toward EF. Before proceeding with the complete data extraction, a pilot test of this table was implemented, involving a few selected studies, to ensure the

appropriate data collection relevant to the review objective and analysis.

### Risk of bias assessment

Two independent reviewers assessed the risk of bias in the included studies. The Joanna Briggs Institute (JBI) critical appraisal checklist was employed to evaluate possible bias in the selected studies [13]. Conflicts arising from discrepancies in the reviewers' decisions were addressed through discussions. The JBI appraisal checklist employs nine items, each evaluated using a scoring system (yes = 1, no = 0, unclear = 0). Numerical and categorical expressions were used to represent the scores achieved in all studies.

### Inclusion and exclusion criteria

#### Population

This systematic review encompassed studies involving nurses in all hospital units except paediatrics and neonatal wards. Pediatric and neonatal nurses were excluded due to the unique nutritional requirements and specialized care for these patients.

#### Outcomes

The primary studies included in this systematic review have yielded findings regarding nurses' knowledge, attitude, and practice regarding EF.

### Study design

Only cross-sectional studies were included in this systematic review. Studies were excluded if they were randomized controlled trials, cohorts, case-control, case series, editorials, and reviews.

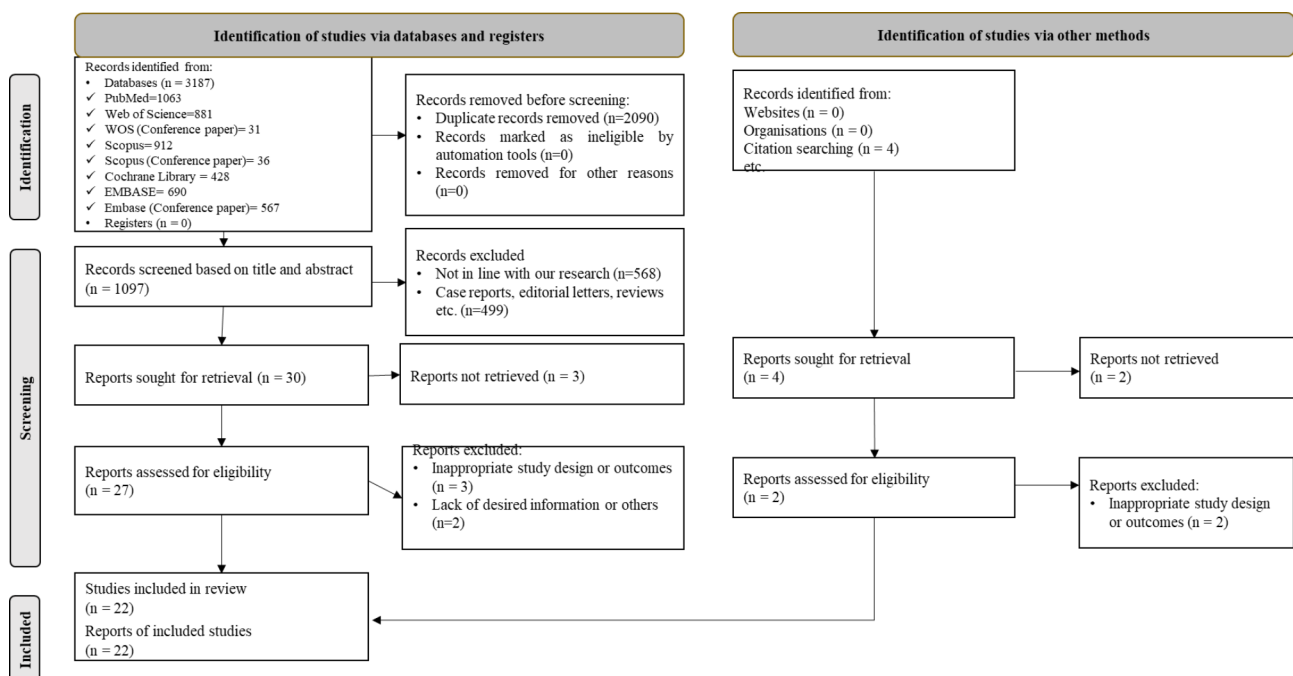
## Results

### Study selection

The initial search yielded 3187 articles across five online electronic databases. Following the removal of duplicates, 1097 studies were selected for further examination. Upon reviewing the abstract and titles, 1067 articles were deemed ineligible. A thorough assessment of full-text articles was conducted to determine eligibility, including 27 articles. Five articles were excluded for several reasons, including studies with inappropriate study design (3 articles), inappropriate participants (1 article), lack of desired information (1 article). The references of excluded studies are presented in Table S2. In adherence to the independent researcher's agreement, a final review was conducted incorporating 22 studies [1, 3, 14–32] (Fig. 1).

### Study characteristics

Twenty studies conducted on 3495 nurses were included in this study. Most studies were conducted in Asia ( $N=11$ ) [14–16, 18, 20, 24, 25, 27–30]. Europe ( $N=5$ ) [10, 17, 19, 21, 23], Africa ( $N=3$ ) [1, 3, 22], and Australia ( $N=1$ ) [26] were next. Of the 22 studies, 17 evaluated knowledge [1, 3, 14, 16–20, 22–29, 31], 15 evacuated



**Fig. 1** PRISMA flow chart

practice [1, 3, 15, 17–19, 21–24, 27, 28, 30, 31] and four evaluated attitudes [1, 3, 18, 28, 32] of nurses toward EF. The details are presented in Table 1.

#### **Risk of bias assessment of included studies**

A combined approach was used to evaluate the quality of the studies, employing two scoring and classification methods. The range of scores fell within the range of 3 to 8. The sample obtained from 17 studies effectively reflected the target population and maintained a satisfactory level of generalizability. Concerning the sampling approach, studies that employed non-random methods were deemed unfavourable. Many studies have failed to explain this phenomenon. When considering the rate of participation and response, it is apparent that several studies have displayed bias, with only one study proposing a viable solution to counteract this limitation. The characteristics of the samples and research settings were adequately reported in most of the studies. One of the primary shortcomings identified in the analyzed studies was using invalid and unreliable tools to assess the outcomes. Table 2 summarises the risk of bias assessment for the included studies.

#### **Enteral feeding knowledge**

The outcomes of two studies demonstrated that most nurses in the studied community, exceeding 65%, possessed substantial knowledge concerning EF [3, 25]. Also, another study found that a majority of nurses, precisely over 80%, possessed a commendable level of knowledge in this area [16].

Nevertheless, in three other included studies, over two-thirds of nurses exhibited insufficient knowledge [14, 17, 22]. Despite the considerable lack of theoretical knowledge regarding EF in a study, its advantages over parenteral nutrition were widely acknowledged [19].

The study by Özbaş et al. revealed that nurses exhibited more excellent knowledge in areas such as peristomal skin problems, feeding position, and interventions focused on preventing nausea and vomiting. The nurses demonstrated lower proficiency in residual volume, pulmonary aspiration, and tube care [10].

Alshammari et al.'s study found that cardiac nurses displayed a high level of awareness regarding nasogastric tube feeding, as evidenced by the high overall mean score on the total awareness scale. Of all the questions asked, the one that received the highest level of awareness was related to the correct positioning of the patient during nasogastric tube insertion. The question about the maximum number of attempts allowed a nurse to insert the nasogastric tube scored poorly in terms of awareness [20].

#### **Enteral feeding attitude**

According to the investigations on nurses' attitudes toward EF, a notable proportion of nurses believed that this feeding approach contributed to a decrease in hospitalization duration for ill patients [1, 3].

According to the findings of two studies, a mere 20.8% [3] and 3.97% [1] of nurses thought that this nutritional method leads to increased workload. On the other hand, in a different study, a higher proportion of nurses (46.2%) shared this opinion [18]. The EF process was considered problematic by less than 10% of nurses [1, 3], except in Hamdan et al.'s study, where this figure reached 40% [18]. Also, 7.14% of nurses believed EF-related documentation in nursing reports is time-consuming [1].

A study revealed that a small percentage (4.4%) of nurses perceived EF as expensive and of no benefit [3]. This number was 30% and 68% in the study of Hamdan et al. and Ramuadaa et al., respectively [1, 18].

According to the study conducted by Wangari et al., 98.5% of nurses recognized the importance of acquiring EF management skills [3]. Similarly, in the study by Hamdan et al., 68% of nurses shared the same belief [18]. Also, 99.2% and 67% of nurses, respectively, acknowledged their responsibility for the correct execution of EF [3, 18].

#### **Enteral feeding practice**

An essential clinical practice component involves evaluating patients' clinical status and reviewing their medical records. These examinations primarily focus on nasal opening, swallowing reflex, and bowel movements. Weekly nutritional assessment of patients was performed by 56.3% of nurses in a study by Wangari et al. Likewise, according to Hadera et al.'s and Wangari et al.'s study, 34.9% and 54.1% of nurses conducted daily nostril checks, respectively [3, 22].

Before and after the feeding procedure, infection control is a critical concern. Before commencing, nurses ought to arrange the essential instruments and ensure their accessibility. According to a study, 95% of nurses adhered to proper handwashing protocols before beginning the procedure. Tube flushing before and after EF was performed by 59.9% [22], 69.5% [18], 71.0% [24], and 79.4% [23] of nurses in the included studies.

To decrease the complications, the patient's head should be raised at least 30–45 degrees in a lying position. In the reviewed studies, most nurses showed a high compliance rate, although Ramuadaa et al.'s study reported a significantly lower rate of 35.3% [1]. In the remaining studies, the level of compliance exceeded 70% [15, 18, 23, 29, 30].

Nurses should consider checking gastric residual volume before initiating EF as an additional measure to minimize the risk of aspiration. In the reviewed studies, most nurses showed a high compliance rate, except Hadera

**Table 1** Basic characteristics of the included studies in this systematic review

Study Authors (Year) Country	Outcome Measures	Study Characteristics 1. Participants 2. Sample size (M/F%)	Study Design	Instrumentation	Main Outcomes
1. Turan et al. 2024 Turkey	1. Knowledge 1. Patients	1. ICU Nurses	Descriptive Cross-study	Online questionnaires	1. Adequate knowledge of the principles of enteral nutrition practice 2. Variation in knowledge of the indication of enteral nutrition formulas 3. Variation in knowledge of the evidence for enteral feeding tubes/ sets.
2. Wangari et al. 2024 Kenya	2. Knowledge 3. Attitude 4. Practice	2. Critical care nurses 3. 135 (36.3/63.7)	Descriptive Cross-study	Standardized questionnaire	1. 65.9% adequate level of knowledge 23% moderate and 11.1% inadequate. 2. 96.3% had positive attitudes 3. 54.7% had competent practices
3. Ramuadaa et al. 2023 South Africa	1. Knowledge 2. Attitude 3. Practice	1. Nurses 2. 207 (21.74/78.26)	Descriptive Cross-study	KAP questions to collect data.	1. The median knowledge score was 46.3% (mean 45.8 ± 13.7%, range 6.3–81.2%). Only one participant achieved the target score of ≥ 80%, and 16.3% scored ≥ 60%. 2. Significant differences were found between knowledge and years of working experience ( $r = -0.01$ ; $p = 0.85$ ). 3. A positive attitude towards EN was found and 96.1% of participants expressed the need for additional in-service training.
4. Al Otaibi et al. 2022 Saudi Arabia	1. Knowledge	1. ICU Nurses 2. 59 (22/78)	Descriptive Cross-study	Self-administered questionnaire about nurses' knowledge EN	1. Adequate knowledge about EN (65% and more).
5. Alshammari et al. 2022 Saudi Arabia	2. Knowledge	1. Cardiac Nurses 2. 87 (0/100)	Descriptive Cross-study	An online questionnaire to collect data about knowledge	1. High level of nurses' knowledge regarding enteral nutrition at the cardiac nursing units.
6. Hadera et al. 2022 Ethiopia	1. Knowledge 2. Practice	1. Nurses 2. 196 (48.4/51.6)	Descriptive Cross-study	Self-administered questionnaire about nurses' knowledge and Practice EN	1. The level of inadequate knowledge and poor practice of nurses relating to enteral nutrition was 67.7% and 53.8%, respectively. 2. Nurses' practice about enteral nutrition was significantly associated with nurses' age, nurses prior training on enteral nutrition, and nurses from ICUs having a guideline and protocol on enteral feeding practice.
7. Hamdan et al. 2022 Palestine	1. Knowledge 2. Attitudes 3. Practice	1. Registered nurses 2. 325 (52/48)	Descriptive Cross-study	Pre-tested structured questionnaire, multiple choice questions, and open-ended questions developed after reviewing previous published papers.	1. The mean of the knowledge score was (9.6 ± 2.8) out of 20. It was confirmed that sociodemographic characteristics has no influence on nutrition knowledge score among nurses. 2. Results also showed that nurses attitudes were positive towards enteral nutrition
8. Batalla et al. 2021 Philippine	1. Knowledge 2. Practices	1. Nurses	Descriptive correlational-study	The Gastric Gavage Knowledge and Practices of Nurses Questionnaire (GGKPNQ)	1. 58.5% of nurses correctly identified X-ray as the gold standard for determining tube placement.

**Table 1** (continued)

Study Authors (Year) Country	Outcome Measures	Study Characteristics 1. Participants 2. Sample size (M/F%)	Study Design	Instrumentation	Main Outcomes
9. Seferoğlu et al. 2021 Turkey	1. Practices	1. Intensive Care Nurses	Descriptive correlational-study	Enteral Nutrition Practice Form (ENPF)	1. The total score of EN practice were $126.82 \pm 16.18$ (range, 35–175). 2. Only 34.6% ( $n=68$ ) of the participants were found to have an acceptable score of sufficiency for positive EN practices. 3. The highest practice score was the "Preventing Complications Related to EN". 4. Lowest score was also "Gastro-Intestinal System (GIS) Tolerance Evaluation".
10. Gok Metin et al. 2020 Spain	1. Knowledge 2. Clinical Competence	2. Nurses 3. 327 (N/A)	Cross-sectional	Self-administered questionnaire about nurses' knowledge and competence EN	1. 2.6% of nurses reported their self-perceived knowledge of EN as "fully" and 12.3% responded "not at all."
11. Jamshidi et al. 2020 Iran	1. Knowledge	1. ICU nurses 4. 101 (N/A)	Cross-sectional	The questionnaire about EN knowledge	1. 9.9%, 38.6%, 45.5% and 6% of the nurses had < 25%, 25–50%, 50–75% and < 75% knowledge about EN.
12. Harjit et al. 2019 India	1. Knowledge	1. Staff nurses 2. 100 (24/76)	Non experimental exploratory	Structure Knowledge Questionnaire	1. Majority (80%) of staff nurses had good knowledge, 12% staff nurses had excellent knowledge and only 8% staff nurses had average knowledge regarding EN.
13. Özbaş et al. 2018 Turkey	1. Knowledge	1. All nurses 2. 170 (N/A)	Descriptive investigation	Self-administered questionnaires	1. Nurses were found to not to have the desired level of knowledge on enteral feeding.
14. Morphet et al. 2016 Australia	1. Knowledge	1. Critical care nurses 2. 359(13/87)	Cross-sectional	Self-administered questionnaires	1. 60% and 10% of respondents reported their enteral nutrition knowledge as good and excellent, respectively. 2. Lacked knowledge regarding the effect of malnutrition on patient outcomes.
15. Sajeevan et al. 2015 Sri Lanka	1. Knowledge 2. Practice	3. Critical care nurses 4. 138(5/95)	Cross-sectional	Structured and pretested questionnaire regarding knowledge and practices	1. Adequate knowledge on EN care in areas of risk associated with EN, patient positioning and prevention of tube occlusions. 2. Inadequate knowledge on suitable administering method of EN and the time of initiation of EN. 3. Desirable practices related to elevation of the head of the bed when feeding, educating patients and their relatives on nutritional requirements and discarding unused feeds.
16. Das et al. 2014 India	1. Knowledge 2. Practice	1. Staff nurses 2. 100 (6/94)	Cross-sectional	Structured interview schedules- Structured questionnaires and observational checklists	1. 44% of staff nurses had above-average knowledge, 44% of staff nurses had below-average knowledge. 2. Staff nurses were having 80% of practice skill regarding consideration before giving feeding, 74% of practice skill regarding during giving feeding, 73% of practice skill regarding after giving feeding.
17. Al Kalaldeh et al. 2013 Jordan	1. Knowledge 2. Attitude 3. Practice	1. ICU nurses 2. 253(56.5/43.5)	Descriptive correlation study	Structured mixed Questionnaire	1. Greater levels of knowledge and responsibility for 'preventing complications'. 2. Inadequately assess both gastric residuals and tube placement before feeding. 3. Lower responsibility scores for nutrition; only 21.7% of nurses considered themselves to be responsible for patient nutrition with the majority (77.9%) reported that someone else has responsibility for nutrition.

**Table 1** (continued)

Study Authors (Year) Country	Outcome Measures	Study Characteristics 1. Participants 2. Sample size (M/F%)	Study Design	Instrumentation	Main Outcomes
18. Ham-mad et al. 2013 Jordan	1. Practices	3. Critical care nurses	Descriptive cross-sectional study	Self-reported questionnaires	1. Initiation time of enteral nutrition and backrest elevation aspects of enteral nutrition practices were consistent with the current best evidences. 2. The amount of high gastric residual volume and its management aspects showed variations and inconsistency with current best evidences. 3. Nurses' practices regarding enteral nutrition were not consistent with international guidelines.
19. Gupta et al. 2012 India	1. Knowledge	2. ICU nurses 3. 40(N/A)	Cross-sectional	Self-administered questionnaires	1. A majority (38) of staff nurses expressed awareness of nutrition guidelines. A large number of staff nurses knew about nutrition protocols of the ICU.
20. Fulbrook et al. 2007 United Kingdom	1. Practices	1. ICU nurses	Cross-sectional	Self-administered questionnaire	1. 86.5% did not use a nutritional risk score 2. 35.8% conducted daily assessments of nutritional status; body weight and serum albumin were the commonest measures. 3. 72.6% check the position of the feeding tube using auscultation of injected air was widespread.
21. Wentzel Persenius et al. 2006 Sweden	1. Knowledge 2. Practice	3. ICU nurses 4. 44	Cross-sectional	49-item questionnaires	1. Consultation with colleagues was the main sources of knowledge.
22. Ista et al. 2002 Belgium	1. Knowledge 2. Training	1. ICU nurses 2. 77 (21/79)	Cross-sectional	Standardized questionnaire	1. Poor level of theoretical knowledge of enteral nutrition, 2. Weak practice of Enteral Nutrition in ICU nurses.

EN, enteral nutrition; ICU, intensive care unit; KAP, Knowledge, Attitude, Practice

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**Table 2** A summary of the risk of bias assessment for the included studies

Author	Was the sample frame appropriate to address the target population?	Were study participants sampled in an appropriate way?	Was the sample size adequate?	Were the study subjects and the setting described in detail?	Was the data analysis conducted with sufficient coverage of the identified sample?	Were valid methods used for the identification of the condition?	Was the condition measured in a standard, reliable way for all participants?	Was there appropriate statistical analysis?	Was the response rate adequate, and if not, was the low response rate managed appropriately?	Overall appraisal
1 Turan et al. 2024	Y	Y	U	Y	Y	Y	U	U	Y	6
2 Wangari et al. 2024	Y	Y	U	Y	U	Y	U	Y	Y	6
3 Ramuadada et al. 2023	Y	Y	Y	Y	U	Y	U	Y	U	6
4 Al Otaibi et al. 2022	N	N	N	Y	Y	Y	U	Y	Y	5
5 Alshammari et al. 2022	U	N	U	Y	Y	Y	U	Y	Y	5
6 Hadera et al. 2022	Y	Y	Y	Y	Y	Y	U	Y	Y	8
7 Hamdan et al. 2022	Y	Y	Y	Y	Y	Y	U	Y	Y	8
8 Batalla et al. 2021	Y	U	U	Y	Y	Y	U	Y	Y	6
9 Seferođlu et al. 2021	Y	Y	Y	Y	Y	Y	U	Y	Y	8
10 Gok Metin et al. 2020	U	U	Y	Y	N	Y	U	Y	N	4
11 Jamshidi et al. 2020	Y	U	Y	Y	Y	Y	U	U	Y	6
12 Hajiti et al. 2019	Y	U	U	Y	Y	Y	U	Y	Y	6
13 Özbaş et al. 2018	Y	U	Y	Y	U	Y	U	U	U	4
14 Mirphet et al. 2016	Y	U	Y	Y	Y	Y	U	Y	Y	7
15 Sajeewan et al. 2015	Y	U	U	U	Y	Y	U	Y	Y	6
16 Das et al. 2014	Y	Y	U	Y	U	Y	U	Y	U	5
17 Al Kalalideh et al. 2013	U	Y	Y	Y	U	Y	U	Y	U	5
18 Hamed et al. 2013	Y	U	Y	Y	U	Y	U	Y	U	4
19 Gupta et al. 2012	Y	U	U	Y	U	Y	U	U	N	3
20 Fullbrook et al. 2007	Y	Y	Y	Y	U	Y	U	Y	U	6
21 Wentzel Pensenius et al. 2006	U	Y	U	Y	U	Y	U	Y	N	4
22 Ista et al. 2002	Y	U	Y	Y	U	Y	U	U	U	4

Yes: Y No: N Unclear: U Not applicable: N/A



et al.'s study, which reported a significantly lower rate of 39.1% [22]. In the remaining studies [18, 19, 30], compliance levels consistently surpassed 70% and eventually reached 100%, as reported by Gupta et al. [29].

The next step is to ensure the correct placement of the nasogastric tube. A low level of examination before feeding was observed in two studies, with percentages of 28.9% [18] and 24.6% [26]. Furthermore, according to the study conducted by Hadera et al., a significant majority of nurses (59.4%) employed various techniques to ensure accurate tube placement before initiating feeding [22].

In the reviewed studies, four main techniques were discussed to verify the proper positioning of the tube. Auscultation, litmus test, X-ray, and aspiration were among these techniques. Auscultation is the most widely used and prevalent method among nurses. In every study, over 60% of nurses employed this approach [3, 15, 17, 21, 28, 29]. With regards to the litmus test, apart from one study [30], the percentage was below 30% in all other studies [1, 17, 21, 23, 28], and three studies revealed that less than 10% of nurses utilize this approach [17, 21, 28]. There has been a significant and unacceptable improvement in the use of X-rays. X-rays are more commonly recommended for the initial confirmation of placement. The study results indicated that the utilization of this method was at a moderate level, with over 30% of participants relying on it in three studies [21, 23, 30]. Out of these, only two studies assessed the utilization of aspiration. In the two studies mentioned above, 55% [15] and 30.5% [21] of nurses employed this approach.

Concerning the implementation of the feeding process, Wangari et al. found that 77% of the nurses appropriately adjusted the feeding rate [3]. In contrast, another study reported a compliance rate of only 16.4% among the nurses [1]. One can deliver EF products to the digestive system using continuous or intermittent nutrition. To ensure uninterrupted delivery, the patient is continuously supplied with the nutritional solution via a pump for 16 to 24 h. Its benefits encompass the mitigation of aspiration risk arising from reflux or high gastric residual volume (GRV), precise delivery into the intestine, and facilitation of blood glucose level management. The EF product is continuously given at a constant speed using a feeding pump. Two studies [19, 23] revealed that 60% of nurses favour this approach, yet a study by Hammad et al. indicated that only 33% of nurses prefer this method [15].

In the principles of administering drugs through a nasogastric tube, an interesting study discovered that 93.4% of nurses opt to administer drugs individually and refrain from mixing them [23]. A significant proportion (61.5%) of nurses, as discovered in another study, administered medication to patients with food [30]. Prior to and following drug administration, 25 cc of water was administered to patients by 40% of nurses [19].

## Discussion

The primary objective of this systematic review was to examine and analyze the knowledge, attitude, and practice of nurses in relation to EF. Based on the results of this systematic review, it can be concluded that nurses tend to hold a positive attitude towards EF. Nevertheless, there is a need to enhance their knowledge and practice in this area.

The review findings emphasized the pivotal role that clinicians play in various aspects of EF, including nutritional assessment, determining the appropriate time to initiate feeding, selecting the proper access method, choosing the right enteral formula, effectively managing complications, and ultimately facilitating the patient's return to their normal nutrition [33]. In another review study, a comprehensive analysis was conducted on the essential tasks nurses perform in the context of EF, revealing nurses' significant impact in preventing complications, decreasing hospitalization durations, and improving patients' quality of life [34]. Based on the findings of our comprehensive systematic review, it is evident that nurses continue to exhibit inadequate knowledge and practice across various aspects. Educational interventions have shown to be successful in enhancing the understanding and practice of these nurses. A study investigating the impact of a training program on nurses' practice regarding EF for premature neonates in the neonatal intensive care unit found that the program significantly improved nurses' practice in initiating and managing EF [35]. Nonetheless, few studies have explored educational techniques to enhance the practice and knowledge regarding EF in nurses caring for adult patients, thus emphasizing the need for future research in this area.

Contrary to our initial imagination and predictions, the studies encompassed in this systematic review have exhibited a considerable variation in terms of methodology. The diversity is predominantly attributed to differences in the tools employed, the tools' validity, and the data collection approaches. Cross-sectional designs were predominantly used in studies examining knowledge, attitude, and practice. Hence, one of the inclusion criteria for this systematic review study pertained to these types of studies. Despite these designs' quick and cost-effective nature, they can pose challenges to interpreting relationships and inferring causality [36, 37]. Employing a qualitative or mixed method design can yield more comprehensive and precise responses from participants than self-report instruments [38, 39].

The divergent approaches used for evaluating identical variables across different studies have posed a significant challenge during the execution of this systematic review. The utilization of various instruments to assess the same variables raises concerns about the consistency of survey

results. Recurrent adaptations and replications may hinder the precision of the instrument construct. Some studies did not examine the instrument's validity. The strength of instruments depends on the psychometric test scores [40]. Throughout the data-collection process, it is essential to consider the reliability of the research. The data must remain stable, precise, and reproducible when using a data-collection method or tool. One must ensure the methodology is meticulously planned and consistently implemented, mainly when multiple researchers participate in data collection [41].

Many items have been consistent with the alterations made to the questionnaires. To enhance convenience and summarize the common findings across multiple studies, we have represented these findings through visual illustrations in Figs. 2, 3 and 4. The utilization of self-report questionnaires presents various limitations, including the

potential overstatement of compliance rate, recall biases, prevalence of floater responses, and acquiescence or agreement bias [42].

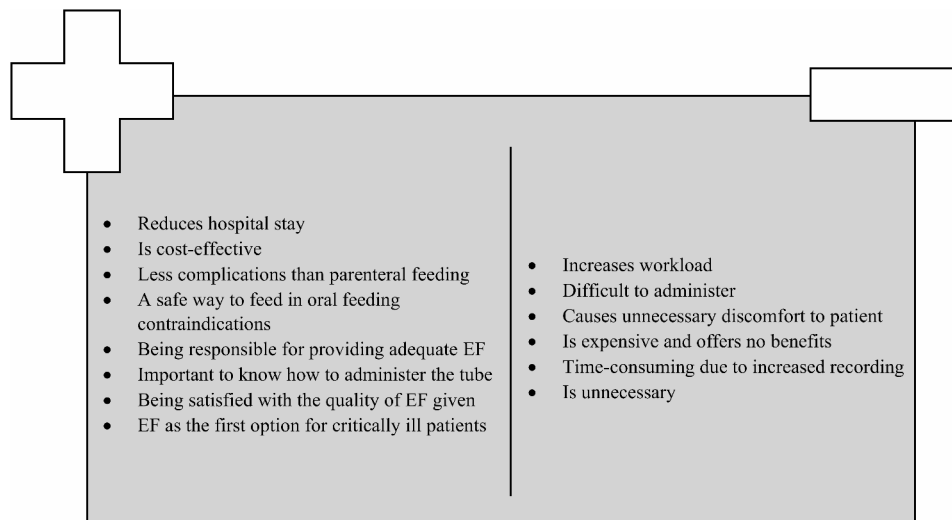
One can achieve a more accurate evaluation of practices by utilizing direct observation as a method for data collection, along with the use of validated instruments. Direct observation is usually chosen rather than other data collection methods, specifically where the researchers want to evaluate behaviours [43, 44].

Most of the selected studies employed a convenience sampling method. Using convenience sampling can pose difficulties in terms of generalizability and may cause limited external validity [45, 46]. Simple random sampling, systematic sampling, stratified sampling, and cluster sampling are four types of random sampling methods that future studies could employ [47].

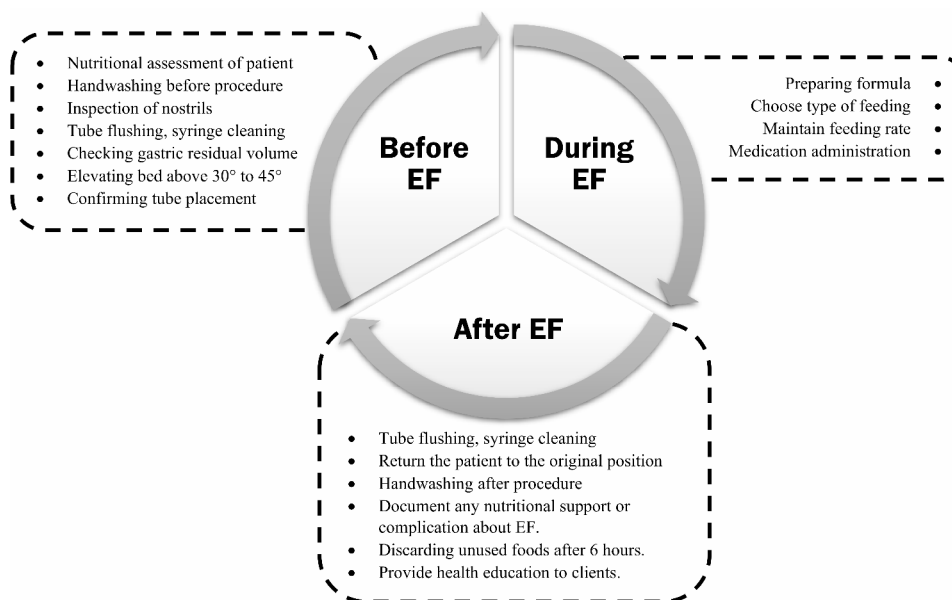
## Main aspects of knowledge regarding EF

- Definition of EF
- Benefits of EF
- Complications of EF
- Indications for EF
- Contraindication for EF
- Types of EF
- Awareness of EF guideline
- Availability of EF protocol
- Sources of knowledge about EF
- Challenges/barriers with delivering EF
- Safe methods to confirm nasogastric tube placement
- Proper patient position during nasogastric intubation
- Factors affect the patients' nutritional needs
- Medication administration
- Amount of residual gastric volume for EF to be withheld
- The time for discarding supplied bottle feed (if left unused)
- Best rate for EF
- Correction regarding drug interactions in EF
- Best time for EF initiation
- Food storing considerations
- Food temperature
- Tube care
- Ostoma care

**Fig. 2** The items that were generally investigated by the included studies to investigate the knowledge of nurses regarding EF



**Fig. 3** The items that were generally investigated by the included studies to investigate the attitude of nurses regarding EF



**Fig. 4** The items that were generally investigated by the included studies to investigate the practice of nurses regarding EF

The research conducted by Wentzel Persenius et al. stands out as one of the few studies investigating nurses' practice through direct observation and questionnaires. Incorporating this support allowed for a more accurate portrayal of reality in the study's findings [31]. For example, it was determined that in 40 observations, the mean backrest elevation was 20.7 degrees. Moreover, the mean backrest elevation for the 29 patients who underwent mechanical ventilation was recorded as 19.2 [31].

Although the primary studies have limitations, they verify the necessity of additional training for nurses. The results of interventional studies introducing an educational program for nurses regarding EF led to a significant enhancement in their overall knowledge and practice [4,

48]. Many studies advocate for regularly scheduling continuous training programs for nurses in nasogastric tube feeding. This is necessary to enhance their knowledge and performance and ensure the delivery of high-quality care [2, 49, 50].

Recent studies indicated a lack of fundamental understanding among nurses regarding the regulations surrounding drug administration via EF tubes. The improper preparation and administration of drugs for patients with feeding tubes can affect patients' well-being. Through implementing educational intervention, nurses can substantially enhance their awareness regarding the subject. Activating clinical pharmacists' role and establishing collaboration between pharmacists, physicians, and nurses

are strongly recommended in clinical settings [51, 52]. The recent study utilized a pre-test and post-test design to enhance nurses' understanding of drug administration via EF tubes. The outcomes of this study suggested that engaging clinical pharmacists in this clinical context is highly advisable as it has been associated with boosting nurses' knowledge in this domain [53].

### Limitation

The quality of the primary studies we include can impact our research. The failure to integrate findings from all studies in the meta-analysis weakens the credibility of the results. Nonetheless, the primary aim of this research has been to demonstrate the opportunities and challenges within this field. We hope that forthcoming research endeavours strive to mitigate the current challenges.

### Conclusion

According to the current review, nurses showed a positive attitude toward EF; nevertheless, a necessity exists to enhance their knowledge and practice. It is crucial to consider the significant limitations of the studies included in this systematic review. One limitation involved the utilization of different tools to analyze identical outcomes. Implementing a more standardized method in future studies will facilitate secondary analyses. The combination of continuous education and interdisciplinary cooperation can greatly enhance nurses' knowledge and practice regarding EF.

### Abbreviations

EF Enteral Feeding  
ICU Intensive Care Unit

### Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12912-025-02755-0>.

Supplementary Material 1  
Supplementary Material 2

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None.

### Author contributions

A. Emami Zeydi and A. Zare-Kaseb equally contributed to the conception and design of the research; A. M. Nazari, S. Sarmadi, and A. Ryahin contributed to the acquisition and analysis of the data; A. M. Nazari, S. Sarmadi, and A. Ryahin drafted the manuscript. A. Emami Zeydi and A. Zare-Kaseb critically revised the manuscript. All authors agree to be fully accountable for ensuring the integrity and accuracy of the work and read and approve the final manuscript.

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### Data availability

No datasets were generated or analysed during the current study.

### Declarations

#### Ethics approval and consent to participate

Not applicable because systematic review studies do not receive any information directly from participants.

#### Consent for publication

Not Applicable.

#### Competing interests

The authors declare no competing interests.

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