Enteral Nutrition Management in the Critical Care Patient: Intensive Care Nurses' Practices of Tube Feeding

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Abstract. *Study Objectives:* Maximizing the benefits of enteral nutrition (EN) and minimizing adverse events requires adequate training of the multidisciplinary team, especially nurses, and systematic practice of care practice. This study was aimed at determining the EN practices of intensive care unit (ICU) nurses in Turkey and the factors affecting these practices. *Methods:* "Nurse Information Form" and the "Enteral Nutrition Practice Form" were distributed to 196 intensive care unit nurses to investigate the EN. *Results:* The total score of the nurses on EN practice was 126.82 ± 16.18 (range, 35-175). Only 34.6% (n = 68) of the participants were found to have an acceptable score of sufficiency for positive EN practices. The highest practice score ICU nurses obtained subsections was the "Preventing Complications Related to EN" (4.19 ± 0.50) subsection, the lowest score was also "Gastro-Intestinal System (GIS) Tolerance Evaluation" (2.72 ± 0.68) subsection. While 50.5% of the nurses never paid attention to the amount of product that should be given to the patient at a meal, 23.0% of them never paid attention to the fact that medication that should not be crushed was not given through the feeding tube. *Conclusion:* It was concluded that ICU nurses do not follow the current guidelines on EN practice and have not received adequate training in EN. With a well-designed in-service training program and standard protocols, adherence to evidence-based guidelines can be increased; inconsistencies and errors in the EN practices can be reduced.

Key words: Enteral nutrition, Tube feeding, Intensive care, Critical patient, Nurse.

Introduction

Nutrition is undoubtedly one of the most basic human needs. However, malnutrition remains a critical problem threatening the quality of care and patient safety in hospital settings worldwide (1). Intensive care units (ICUs) are the settings where critical patients are most closely monitored and the risk of malnutrition is most frequently observed (2). Critically ill patients are hypermetabolic and their energy requirements increase due to their disease. Therefore, nutritional support is a vital intervention for ICU patients (3). In the studies, the prevalence of malnutrition has been reported to vary between 10%-60% depending on the status of the disease present during or after admission to an ICU (4-6). Hospital-acquired malnutrition has been associated with many negative outcomes such as increased mortality rate (7), prolonged hospital stay (8), decreased quality of life (9), increased complication rates, and healthcare costs (10).

Given the negative clinical outcomes that may be caused by malnutrition, assessing patients' nutritional status and identifying the risk of malnutrition risk is critical for starting the nutritional support that patients need promptly (11). EN should be chosen for ICU patients at the earliest stage if oral intake is not possible. EN, in line with evidence-based practices and initiated for critically ill patients at an early stage, has been reported to improve clinical outcomes, and reduce mortality rates, the length of hospital stay, and health-related costs compared to parenteral nutrition (3,12-14). Many studies have emphasized the clinical importance of EN support for patients in the ICU setting.

However, a review of the literature shows that EN practices are implemented based on rituals and personal opinions rather than evidence-based safe practices (15,16), and patients are not provided with the necessary nutritional support due to differences in practice (5,17-19).

As the etiology of malnutrition is multifactorial, nutritional support involves a multidisciplinary team. Nurses can be considered as the most important team members in improving the quality of nutritional support since they are responsible for administering nutritional products (5, 12, 20). Although a small number of studies, there is an opinion that the provision of multidisciplinary nutritional support may have a positive effect on mortality in literature (12). Nevertheless, nurses should have sufficient knowledge about nutrition and understand its importance for critically ill patients to fulfill their responsibility for providing nutritional support. However, several studies have revealed the necessity to improve the knowledge, attitudes, and practices of nurses working in ICUs related to nutritional support (21-24).

In the Health Quality Standards (HQS) published by the Turkish Ministry of Health in 2015, the provision of nutritional support by a multidisciplinary team by evidence-based recommendations were accepted as the care standard (25). Furthermore, determining the nutritional requirements of patients, planning and implementing the necessary nutritional care are among the legal responsibilities of ICU nurses in Turkey (26). However, despite these regulations in Turkey, studies have shown that nutrition is not considered as a part of nursing practices (27) and that nurses' knowledge (28,29) and practices (30) regarding EN support need to be improved. Nurses' inadequacies related to EN practices remain an issue in Turkey, and further studies are needed to create regulations that can provide solutions to these issues. There was no study conducted in Turkey, assessing the compliance of ICU nurses' EN practices with the recommendations made in the guidelines. This study was aimed at determining the EN practices of ICU nurses in Turkey and the factors affecting these practices.

Material and Methods

This descriptive and cross-sectional study was carried out with nurses working in internal diseases and surgical ICUs of a public and a university hospital located in the Aegean Region of Turkey between March 1, 2018, and August 1, 2019. Ethics committee approval dated and numbered 2019/3- 2011-KAEK-2 was obtained from the Clinical Research Ethics Committee of the relevant university and permission from the ICU unit managers were obtained to conduct the study.

Study Sample

The sample of the study consisted of 215 ICU nurses working, for at least one month, in surgical, cardiovascular surgery, neurosurgery, neurology, cardiology, pulmonary, internal diseases, neonatal ICUs, and post-anesthesia care unit (PACU) of the above-mentioned hospitals. Clinical nurses were not included in the study. During the study, a total of 19 nurses, including seven nurses who were on leave or sick, and 12 nurses who did not want to participate, were excluded from the study. After informing the participants about the purpose of the study, verbal and written consent was obtained from 196 ICU nurses who met the inclusion criteria. The participation rate was thus 91.1%.

Data Collection Tools

The data were collected using the "Nurse Information Form" and the *"Enteral Nutrition Practice Form (ENPF)"* for nurses.

Nurse Information Form: It consists of 24 questions, including 11 personal and professional questions such as age, marital status, education, duration of work in ICU, and the status of EN education, and 13 questions related to the ICU responsibilities such as deciding, preparation, application, monitoring, evaluation, and recording of enteral nutrition in ICUs.

"ENPF" is a questionnaire that aims to evaluate the EN practices of intensive care nurses. During the creation of the questionnaire, a 43-question draft form was created in accordance with the opinions of three researchers from the nursing field, in addition to the literature review (15, 17, 23, 24, 31). For the content validity of the draft form, eight academic nurses and one nutritional support nurse, who were all experts in the field of nutrition, were consulted to evaluate the appropriateness and comprehensibility of the items. Experts, per the Davis technique for content validity (32), graded each item as "Appropriate (4)", "Need Minor Revision (3)", "Need Some Revision (2)", "Not Appropriate (1). The items graded as not appropriate (1) were removed from the questionnaire form, while the items graded as 2 and 3 were revised with the most appropriate statements following the recommendations made by the experts. Finally, the preliminary draft form was applied to a group of 52 nurses working in the ICUs. In the preliminary application, no negative feedback was received regarding the comprehensibility of the items in the draft form, and the final version of the draft form was created. The questionnaire form consists of 35 items and 5 subsections:

(1) Initiating EN: It contains 4 items related to the practices of ICU nurses to initiate enteral feeding and the total score range is 4-20.

(2) Nutritional Assessment: It includes 3 items related to the nutritional assessment practices of ICU nurses and the total score range is 3-15.

(3) Gastro-Intestinal System (GIS) Tolerance Evaluation: It includes 8 items related to the GIS tolerance assessment practices of ICU nurses and the total score range is 8-40.

(4) Preventing Complications Related to EN: It includes 16 items related to ICU nurses' practices to prevent complications related to EN and the total score range is 16-80.

(5) EN in Terminal Stage: It contains 4 items related to the practices of ICU nurses to apply EN to the patient in the terminal stage and the total score range is 4-20.

Each statement in the final form was graded with Likert-type scoring that ranges from 1 to 5 as such; "never apply(1)", "rarely apply (2)", "sometimes apply (3)", "often apply (4)", "always apply (5)". The score range of the data collection form, a 5-point Likert type, is 35-175, and the closer the score of the nurses to the maximum value of 175, the more positive EN practices they have. Participants scored 5 points for the "always" choice and 1 point for the "never". Since there was no definite cut-off value in the range of 35-175, the score range of the questionnaire, in this study, the EN practices of the nurses who scored 75% and above the maximum score (≥131 out of 175) were accepted as sufficient, while a score below 75% (≤130 out of 175) was considered insufficient. Besides, each application practice in the 5 subsections and dimensions in the questionnaire was divided into two categories as sufficient and insufficient. The EN practices of nurses with a scoring average of 75% and above the maximum score (≥3.75 out of 5) in scoring ranging from 1 to 5 for each statement in each sub-section and the dimension were considered as satisfactory (sufficient) application practices (33,34).

In this study, the content validity index based on the opinions of the experts was found to be 0.96 for *ENPF*, used as a data collection tool. Assessment scores from nine experts were evaluated using the Kendall W analysis (Kendall w 0.016; p= 0.978) and it was determined that there was consistency among the opinions of the experts. The Cronbach alpha test was conducted to examine the reliability of the items of the form. Cronbach's alpha was found to be 0.824 and it can be considered highly reliable (35).

Data Collection

An appropriate time outside of treatment and administration hours was chosen for ICU nurses to answer questions in the data collection forms. The ICU nurses were provided information about the study. Their informed consent for participation was obtained after it was explained to the participants that

participation was voluntary. To ensure confidentiality, they were asked to fill in the data collection form anonymously and put it in sealed envelopes. The researchers gathered the forms in these sealed envelopes. It took an average of 20 minutes for participants to answer the questions on the form.

Data Analysis

The research data were analyzed with the SPSS version 22.0 for Windows (SPSS, Inc., Chicago, USA) package program. Descriptive statistics of continuous variables were presented with mean, standard deviation, minimum and maximum values while categorical variables were presented with frequency and percentage. Skewness-Kurtosis values and the Shapiro-Wilk test were used to evaluate the normal distribution of the data and the distribution of the data was found to be normal. In line with this, independent samples t-test for two groups and One-way ANOVA for three or more groups were used for the comparison of the EN behaviors of nurses according to their qualitative characteristics. TUKEY test was used for the

comparisons of groups in pairs according to the results of ANOVA. The statistical significance was accepted as $p < 0.05$.

Results

Characteristics of the ICU nurses

While 52% (n=102) of the participants were female, 53.1% (n=104) had an undergraduate degree. The mean age of the participants was 30±7.61 years, the mean years of experience in nursing 8.25±6.46 years, and the mean duration of employment in the ICU was 4.5±3.83 years. Most of the participants (n=139, 70.9%) had not received any in-service training related to EN and the source of their current knowledge about EN was mostly their colleagues (n=137, 69.9%).

Characteristics of the EN in ICUs

Table 1 presents the findings regarding the characteristics of EN practices in the ICUs. The majority

Table 1. Characteristics of the EN in ICUs

Characteristics	Categories	n	%
Nutrition support team presence	Yes	150	76.5
	No	18	9.2
	Don't know	28	14.3
Nutritional support team members	Doctor, dietitian and nurse	88	44.8
	Dietitian and nurse	46	23.5
	No team	46	23.5
	Only dietitian	8	4.1
	Only nurse	5	2.6
	Only doctor	3	1.5
Healthcare professional performing the nutritional assessment	Only nurse	87	44.4
	Only doctor	85	43.4
	Only dietitian	15	7.7
	Doctor, dietitian and nurse	9	4.5
Main healthcare professional dealing with the patient's nutritional problems	Only doctor	84	42.9
	Only nurse	59	30.1
	Only dietitian	33	16.8
	Dietitian and nurse	14	7.1
	Doctor, dietitian and nurse	6	3.0

Characteristics	Categories	n	%
Use of EN monitoring form	Yes	122	62.2
	No	56	28.6
	Don't know	18	9.2
Type of form used [†]	Nutritional risk screening form (NRS-2002)	91	46.4
	Patient nutritional status monitoring form	68	34.7
	Nutrition support team consultation form	58	29.6
	Patient food intake record form	18	9.2
Healthcare professional who determines the patient's enteral product requirement	Only doctor	119	60.7
	Only dietitian	64	32.7
	Doctor, dietitian and nurse	10	5.1
	Only nurse	3	1.5
Healthcare professional who determines the patient's daily energy requirement	Only doctor	102	52.0
	Only dietitian	85	43.4
	Only nurse	7	3.6
	Doctor and nurse	2	1.0
Most common access method for EN	Nasogastric	183	93.4
	PEG	13	6.6
Most common feeding method for EN	Intermittent feeding	119	60.7
	Continuous feeding	61	31.1
	Interruption	16	8.2
Interrupting EN at night	Yes	138	70.4
	No	58	29.6
Method used to confirm feeding tube placement	Auscultatory method	194	99.0
	X-Ray	1	0.5
	pH measurement	-	-
	Don't know	1	0.5
Number of patients who feed enterally (monthly)	M±SD 7.39±7.61		

[†]Multiple options can be selected.
EN: Enteral Nutrition, PEG:Percutaneous Endoscopic Gastrostomy   T: Total   M: Mean   SD: Standard Deviation

of the ICU nurses (n=150, 76.5%) stated that there was a separate individual multidisciplinary nutritional support team for the nutritional support in ICUs. Most of them (n= 88, 44.8%) reported that this team consisted of doctors, dieticians, and nurses. The ICU nurses reported that the nutritional assessment of the patient during the admission to the ICUs was mostly performed by the ICU nurse (n=87, 44.4%) or the doctor (n=85, 43.4%) and that the person dealing with the nutritional problems of patients was primarily the doctor (n=84, 42.9%) or the ICU nurse (n=59, 30.1%). The EN products and daily energy requirements of patients receiving enteral nutrition in ICUs were usually decided by the doctor (60.7% and 52.0%, respectively) and the dietician (60.7% and 52.0%, respectively). The ICU nurses stated of using mostly the nasogastric route for EN (93.4%), and intermittent feeding (60.7%) as the feeding method. Almost all of the participants (n=194, 99.0%) reported checking the position of the tube placed for EN with the auscultatory method.

The total score of the participants on EN practices was 126.82 ± 16.18 (range, 35-175). The mean practice score for EN on a 5-point Likert was 3.62 ± 0.46 ($\bar{X}$ ± SD). Only 34.6% (n=68) of the participants

were found to have a total EN practice score of 131 and above out of 175 (the acceptable score of sufficiency for positive EN practices).

According to Table 2, sub-dimension mean scores of the participants were as followed: 3.28 ± 0.46 for initiating EN, 3.27 ± 1.18 for Nutritional Assessment, 2.72 ± 0.68 for GIS Tolerance Evaluation, 4.19 ± 0.50 for Preventing Complications Related to EN, and 3.85 ± 1.17 for the EN in Terminal Stage. Sub-dimension mean scores of the participants were examined in terms of acceptable sufficiency score (75% and above) for positive practices. Accordingly, it was determined that only 23.4% (n= 46) of ICU nurses had a positive practices score for Initiating EN practices score

Table 2. Characteristics of the EN behaviors of the ICU nurses (N= 196)

Items of behavior	Never %	Rarely %	Sometimes %	Frequently %	Always %	M±SD
Initiating EN (T±SD; Min-Max): (13.11±3.07; 7-20)						3.27±0.76
1. If there is no recommendation, I start continuous enteral feeding with 10-20 ml/hour	31.6	12.8	23.5	24.0	8.2	2.64±1.36
2. In intermittent feeding, I give a maximum of 400 ml of food at once	50.5	8.2	11.7	19.4	10.2	2.31±1.49
3. I confirm the position of the tube each time before feeding or drug administration	0.5	3.6	10.7	29.1	56.1	4.37±0.85
4. In intermittent feeding, I make sure to give the nutritional product in a period of 30-60 minutes 4-8 times a day	4.6	5.1	24.0	38.8	27.6	3.80±1.05
Nutritional assessment (T±SD; Min-Max): (9.82±3.55; 3-15)						3.27±1.18
5. I perform the nutritional risk score assessments of patients in our unit	30.6	8.2	9.7	15.3	36.2	3.82±1.42
6. I perform the daily physical assessment of the enterally-fed patient and track weight	27.6	14.3	20.9	23.0	14.3	3.18±1.70
7. I fill out the nutritional assessment registration form of the patient completely	14.8	4.1	19.7	27.0	44.4	2.82±1.42
Gastrointestinal system tolerance evaluation (T±SD; Min-Max): (24.48±6.17; 9-40)						2.72±0.68
8. As long as the enterally-fed patient can tolerate it, I double the infusion rate every 8-10 hours	38.3	15.8	21.4	17.3	7.1	2.39±1.34
9. If gastrointestinal intolerance (abdominal pain, nausea, diarrhea, distension) develops, I return to the previous feeding rate (h/ml).After the problem is solved, I increase the infusion rate again	11.2	8.2	19.4	38.8	22.4	3.53±1.24
10. I check the gastric residue every 4 hours. If the residue is less than 50% of given or less than 150-200 ml, I double the dose	33.2	14.8	23.0	24.0	5.1	2.53±1.31
11. If the gastric residue is more than 500 ml, I stop feeding. If it is 150-500 ml, I continue feeding	15.8	14.8	22.4	28.6	18.4	3.19±1.33

Items of behavior	Never %	Rarely %	Sometimes %	Frequently %	Always %	M±SD
12. I initiate enteral nutrition with solutions such as isotonic solution to increase GIS tolerance	36.7	14.3	24.5	17.3	7.1	2.44±1.33
13. I gradually increase the amount of nutrients to increase GIS tolerance	9.2	5.1	16.3	32.1	37.2	3.83±1.24
14. I use the continuous infusion method to increase GIS tolerance	18.9	15.8	24.0	21.9	19.4	3.07±1.38
15. I let the patient rest at night during the enteral nutrition program; I do not feed at night	16.8	8.2	14.3	29.1	31.6	3.51±1.44
Preventing complications related to EN (T±SD; Min-Max): (67.10±8.04; 39-80)						4.19±0.50
16. I store the enteral nutrition product in the refrigerator after opening it and dispose of any nutritional product that is not consumed within 24 hours	8.7	1.5	9.2	25.0	55.6	4.17±1.21
17. I change the enteral feeding set bags every 24 hours	3.1	1.0	6.1	18.9	70.9	4.54±0.90
18. I ensure that the patient is in a semi-sitting position during and after enteral feeding	0.5	2.0	5.1	25.0	67.3	4.57±0.73
19. I examine the nostrils daily to evaluate the pressure damage that may occur in the nose due to the feeding tube	2.6	4.1	13.3	22.4	57.7	4.29±1.01
20. I do not administer drugs that should not be pulverized through the enteral feeding tube	23.0	13.3	21.4	16.3	26.0	2.91±1.50
21. I clean or replace the syringe I use for intermittent feeding after each use	15.6	4.1	19.9	34.2	36.2	3.91±1.11
22. I start off by giving the enteral product slowly to prevent abdominal distension and nausea/vomiting, then increase the rate slowly during enteral nutrition	2.0	4.1	14.3	35.2	44.4	4.16±0.96
23. I do not give cold feeding solution to the patientdue to the potential forgastric cramps	2.6	1.0	11.2	30.6	54.6	4.34±0.91
24. I ensure that the feeding solution does not hang for more than four hours to prevent bacterial growth in the feeding bag and tubes	6.1	3.6	15.3	29.1	45.9	4.05±1.14
25. I wash the tube with 50 ml of warm water to prevent clogging in the tube	4.1	7.7	20.9	33.2	34.2	3.86±1.10
26. I check the injury site and dressing after PEG	-	2.0	8.2	22.4	67.3	4.55±0.73
27. I change the feeding set every 24 hours.	12.8	11.7	14.3	23.5	37.8	3.62±1.41
28. I monitor for possible complications related to enteral nutrition in the patient	0.5	4.6	11.7	29.6	53.6	4.31±0.89

Items of behavior	Never %	Rarely %	Sometimes %	Frequently %	Always %	M±SD
29. I regularly measure the blood glucose of the patient and monitor electrolytes	1.0	2.0	13.3	27.6	56.1	4.36±0.86
30. I regularly monitor and record the intake and vomiting of the patient	-	1.5	5.1	13.8	79.6	4.71±0.63
31. I apply daily oral care to the patient	-	1.5	2.6	13.8	82.1	4.77±0.57
EN in terminal period (T±SD; Min-Max): (12.34±4.69; 4-20)						3.85±1.17
32. I check the consent of the patient who will undergo gastrostomy	20.4	9.7	12.2	13.8	43.9	3.51±1.60
33. I provide training on enteral nutrition care to the family of terminal patients who is to be discharged	17.9	10.2	19.9	17.9	34.2	3.40±1.49
34. I use the enteral route for the feeding the terminal cancer patients in the clinic	26.5	13.3	20.4	19.9	19.9	2.93±1.48
35. I ask the opinions and preferences of the terminal patient and his/her family when deciding whether to interrupt or stop enteral nutrition	38.3	16.3	15.3	17.9	12.2	2.49±1.46
General (overall) scale (T±SD; Min-Max): (126.82±16.18; 85-175)						3.62±0.46

EN: Enteral Nutrition, GIS: Gastro Intestinal System, PEG: Percutaneous Endoscopic Gastrostomy, T: Total, M: Mean, SD: Standard Deviation

(≥15 out of 20), 38.2% (n=75) of them for Nutritional Assessment (≥11 out of 15), 30.1% (n=59) of them for GIS Tolerance Evaluation (≥30 out of 40), and 36.7% (n=72) for EN in Terminal Stage (15 out of 20) while 82.6% of them had a positive practices score for Preventing Complication Related to EN (≥60 out of 80).

In the Initiating EN subsection, "In intermittent feeding, I give a maximum of 400 ml of food at once." ($\overline{X}$=2.31) and "If there is no recommendation, I start continuous enteral feeding with 10-20 ml/hour." ($\overline{X}$=2.64) were the items with the lowest mean scores. In this subsection, the "I confirm the position of the tube each time before feeding or drug administration." ($\overline{X}$=4.37) item was the item with the highest mean score.

In the Nutritional Assessment subsection, while the "I fill out the nutritional assessment registration form of the patient completely." ($\overline{X}$=2.82) was the item with the lowest mean score, the "I perform the nutritional risk score assessments of patients in our unit." ($\overline{X}$=3.82) was the item with the highest mean score.

In the GIS Tolerance Evaluation subsection, "As long as the enterally-fed patient can tolerate it, I double the infusion rate every 8-10 hours." ($\overline{X}$=2.39), "I check the gastric residue every 4 hours If the residue is less than 50% of given or less than 150-200 ml, I double the dose." ($\overline{X}$=2.53), and "I initiate enteral nutrition with solutions such as the isotonic solution to increase GIS tolerance." ($\overline{X}$=2.44) were the items with the lowest mean scores. The "I gradually increase the number of nutrients to increase GIS tolerance." ($\overline{X}$=3.83) item was the item with the highest mean score.

In the Preventing Complications Related to EN subsection, the "I do not administer drugs that should not be pulverized through the enteral feeding tube." ($\overline{X}$=2.91) item was the item with the lowest mean score. On the other hand, "I apply daily oral care to the patient." ($\overline{X}$=4.77) and "I regularly monitor and record the intake and vomiting of the patient." ($\overline{X}$=4.71) were the items with the highest mean scores.

In the EN in Terminal Stage subsection, while the "I ask the opinions and preferences of the terminal

patient and his/her family when deciding whether to interrupt or stop enteral nutrition." ($\overline{X}$ =2.49) was the item with the lowest mean score, the "I check the consent of the patient who will undergo gastrostomy." ($\overline{X}$ =3.51) was the item with the highest mean score.

Comparison of ICU nurses' top practices scores according to their characteristics

Table 3 presents the analyses of the ICU nurses' mean practice scores according to their personal and professional characteristics. According to the findings, it was determined that the practice scores of the participants did not show significant differences in terms of gender and level of education. There was no correlation between the EN practices scores of the participants and duration of employment in the ICU or the mean number of patients who were fed enterally (p > 0.05, Table 3). However, the EN practices scores of the ICU nurses showed a statistically significant difference according to the institution of employment and the type of ICU (p=0.001 and p= 0.016, respectively (Table 3). According to the Pearson correlation analysis, the EN practices scores of participants had a positive correlation with age (r_p= 0.273; p < 0.001), years of experience in nursing (r_p=0.223; p=0.002), and the daily number of patients given care (r_p= 0.204; p=0.004) (Table 3).

Discussion and Conclusion

Nurses should have a sufficient level of knowledge to be able to assess the nutritional status of patients and initiate and manage the necessary nutritional support as per evidence-based recommendations. This study investigated the EN practices of Turkish nurses working in the critical care settings in two hospitals located in the Aegean Region of Turkey and some factors affecting these practices.

Although it was determined in this study that ICU nurses took an active role in nutritional assessment and the management of nutritional problems of the patients, it is noteworthy that most of them did not receive any in-service training. It was also found out that ICU nurses acquired their knowledge

about EN mostly from their colleagues. Similarly, the results of both international and national studies show that nurses in the critical care field mostly satisfy their information needs related to EN by consulting their colleagues (24, 29, 30, 36-38). The reason for the nurses' tendency to obtain information from a colleague to overcome their lack of knowledge on EN may be because the information can be obtained quicker this way and can be easily applied to clinical practice (23). The knowledge of experienced nurses in a field can positively contribute to the development of other nurses, however, it does not necessarily give an idea that evidence-based information is used in these environments (20). The basic principle is that decisions on all nursing practices should be based on scientific study results and these study results should be selected for evidence-based practices (20). This indicates the necessity of in-service training courses for EN care and practices, and EN-related courses in the curriculum of nursing schools to improve the EN practices of ICU nurses to the desired level.

In this study, ICU nurses were determined to display inadequate practice levels related to EN care according to their overall EN scores. The above findings show the gaps in the inadequacy of ICU nurses' practices regarding EN management. Inconsistent practices of nurses in feeding critically ill patients may be added as a secondary problem to nurses' lack of knowledge. Studies conducted at both international (21,23,24,38) and national levels (27-30) report wide differences, which may be associated with knowledge gaps or lack of standardization in the care setting, in nurses' management of nutritional support.

The basic principle is that decisions on all nursing practices should be based on scientific study results and these study results should be selected for evidence-based practices (20). This indicates the necessity of in-service training courses for EN care and practices, and EN-related courses in the curriculum of nursing schools to improve the EN practices of ICU nurses to the desired level. A multicenter study conducted in twenty European countries to determine the current nutritional practices revealed that practices in many ICUs were not consistent with international guidelines for EN and that the participation of ICU nurses in nutritional assessment or clinical protocol

Table3. Comparison of ICU Nurses' EN behavior scores according to their characteristics

Characteristics	Categories	n	M±SD	t/F	p
Gender	Female	102	126.45±15.94	t= -0.379	0.705*
	Male	94	127.32±16.51		
Level of education	Health vocational high school	43	125.06±16.66	F= 0.335	0.800**
	Associate degree	39	128.64±18.82		
	Undergraduate degree	104	127.00±14.78		
	Postgraduate degree	10	126.40±18.76		
Institution	State hospital	116	130.09±16.97	t= 3.449	0.001*
	University hospital	80	122.20±13.77		
Type of ICU	Post-anesthesia care (PACU)	43	123.95±16.72	F= 2.422	0.016**
	Surgical	30	125.48±12.16		
	Internal diseases	30	134.31±22.50[a]		
	Pulmonary	26	122.92±16.05[b]		
	Neurology	17	135.21±16.55[a]		
	cardiology	16	123.68±11.76		
	Cardiovascular surgery	13	130.76±8.46		
	Neurosurgery	13	119.64±13.93[b]		
	Neonatal	8	129.25±14.42		
In-service training related to EN	Yes	57	120.47±16.32	t= -1.977	0.049*
	No	139	125.35±15.45		
	M±SD				
Age (years)		30±7.61		r_p= 0.273	0.000***
Years employed in nursing (years)		8.25±6.46		r_p= 0.223	0.002***
Years employed in ICU		4.5±3.83		r_p= -0.016	0.823***
Number of patients who were given care (daily)		3.43±1.52		r_p= 0.204	0.004***
Number of patients who feed enterally (monthly)		7.39±7.61		r_p= 0.001	0.994***

EN: Enteral Nutrition, ICU: Intensive Care Unit, **PEG**: Percutaneous Endoscopic Gastrostomy, T: Total, M: Mean, SD: Standard Deviation
*Independent samplest test was used
**One-way ANOVA test was used
***r_p: Pearson correlation analysis was used
[a,b] Different superscripts within the same column indicate significant difference among groups (p<0.05); Significant at the level p < 0.05

development processes was at minimal levels.[39] All of these can prevent nurses from adequately feeding, evaluating, and managing their patients. Good nutritional care requires nurses to decide on the needs of patients, implement them appropriately, and monitor and record them (23).

The highest practice score ICU nurses obtained among five subsections was the "Preventing Complications Related to EN" subsection. In a similar study, the knowledge of nurses on "Preventing Complications Related to EN" was found to be better (24). This can be interpreted as nurses pay more attention to identifying and preventing the complications that may develop due to tube feeding from the nursing care practices. However, as part of the multidisciplinary nutritional support team, nurses in the critical

care area are important team members who have independent roles at every stage of patients' nutritional assessment, initiating, maintaining, and terminating the nutritional support. Therefore, it is important for them to be aware of and take responsibility for their EN roles at every stage. The findings of this study revealed the need for institutional procedures and educational interventions aimed at improving awareness in the responsibility areas related to EN for Turkish ICU nurses.

The lowest practice score ICU nurses obtained among five subsections was the "GIS Tolerance Evaluation" subsection. In GIS tolerance evaluation, residual volume measurement helps the evaluation of intolerance related to EN (40). In this study, the ICU nurses were found to have deficiencies in their practices regarding the regulation of EN rate according to the Gastric residual volume (GRV) evaluation. Mula et al. reported that the GRV evaluation practices of African ICU nurses were insufficient (20). Gupta et al. determined that Indian ICU nurses always checked the GRV, however, there were differences among them in terms of which residual volume they considered for the next feeding step (21). In their study, Özbaş et al. reported that the vast majority of Turkish nurses failed GRV management and that their practices should be improved (28). The development of nutritional protocols about evidence-based guidelines and implementation of these protocols in nursing care practices will contribute to the reduction of complications that may occur due to EN.

In this study, most of the ICU nurses were determined to provide the product to be given to the patient at a meal without paying attention to the correct volume. While, for intermittent feeding, it is generally recommended to apply a volume of 200-500 ml for a period of 30-120 minutes 3-8 times a day, it is recommended to start feeding at 20-50 mL/hour and to increase the nutrient volume by 10-25 ml every 4-24 hours for continuous feeding (41). The findings in this study contradict these recommendations.

In this study, although more than half of the ICU nurses were determined to always check the position of the tube before feeding or giving medication, almost all of the nurses stated using the auscultatory method for verification. However, the auscultatory method is not reliable (42). While the National Patient Safety Agency (NPSA, 2011) and National Dutch guideline (2011) recommend a pH value equal to or greater than 5.5 for tube aspirate to verify the position of the feeding tube, the American Critical Care Association (AACN, 2010) recommends x-rays to be taken before the administration of products, medications or fluids and each time a new tube is inserted (15, 16, 43). Abdominal radiographs are the "gold standard" for confirming the position of the EN tube, but in most patients, it is impractical to have frequent x-rays only to confirm the position of the tip of the tube (15, 42). Methods such as insufflation and auscultation alone have been reported to probably lead to misinterpretations in determining the position of the tube (15, 42, 44). The pH value of 5.5 from the tube aspirate is sufficient to check the position of the tube in the stomach (42).

Nurses in ICUs are responsible for drug treatment through the enteral feeding tube and use this intervention frequently (45). However, the current study showed that almost a quarter of the participants administered drugs that should not be pulverized through the feeding tube. Similarly, both international and national studies have drawn attention to inconsistencies and unsafe practices in nurses' enteral drug administration (24, 46). Alheshemi et al. reported that an in-service training program given by clinical pharmacists could significantly improve how ICU nurses administer drugs through enteral feeding tubes (45). Such an educational intervention may also be beneficial for the participants of this study.

The EN practices scores of the participants did not show a difference according to the education levels in this study. Unlike our findings, some studies have revealed that higher levels of education create a significant difference in terms of nurses' knowledge and practices in regards to nutrition (23, 29). Theilla et al. stated that an increase in the level of education is an important determinant of nutritional care knowledge (47). However, similar to the findings of this study, the EN knowledge level of nurses did not differ according to their education levels in other studies conducted in Turkey (28). This may be due to insufficient coverage of EN in the nursing curriculum in Turkey. This opinion has been supported by the fact that ICU nurses reported their colleagues as the main resource of EN

knowledge. Including more teaching of EN support in the nursing curriculum may help to educate more nurses who are competent with the EN and thus improve nursing practices.

Another key finding of this study was that the mean practices score of the nurses who had received in-service training on EN was significantly higher. According to the relevant literature, professional and effective training interventions improve nurses' competencies in nutrition and make a positive contribution to patient care outcomes (36). Another finding obtained from this study was that the EN practices scores of the participants from public hospitals were significantly higher. This may be due to the differences in practices between institutions. Practices related to the HQSs have been part of the corporate culture in public hospitals affiliated with the Turkish Ministry of Health for several decades. Consequently, the fact that nutritional support, one of the patient care standards, has been provided by multidisciplinary nutritional support teams in public hospitals for a longer time compared to the private sector or university hospitals may have created differences between institutions in terms of nursing practices (12). Moreover, some of the participants stated not being aware of the existence of a multidisciplinary nutritional support team in their hospital. It also supports the idea that this multidisciplinary team's functions may differ between institutions. A Meta-analyses study found that the provision of multidisciplinary nutritional support may have a positive effect on mortality and improves the quality of life in older patients (12). More effort is required in Turkey in working out how to improve collaboration in multidisciplinary teams to assist nurses with the provision of nutritional support.

This study revealed that the EN practices scores of the ICU nurses were positively correlated with the years of experience in nursing and the number of patients given care. It is a known fact that the skill gets perfected with practice and this can have an effect on the management of patients (48). Experience can be considered as the ability to identify possible complications that may arise in the implementation of nutritional methods and nutritional methods that are best for a patient. However, in this study, there was no correlation between the total EN practices scores of the ICU nurses and years of experience in ICU and the number of patients who received EN. This suggests that long-term nursing experience without any additional professional education on nutrition may not contribute to nurses' knowledge and skills regarding nutritional care. These results revealed the need for continuous training on the responsibilities of nurses in every step of the enteral nutrition process and the development of institutional procedures. With the implementation of a well-designed in-service training program and standard protocols, adherence to evidence-based guidelines can be increased, inconsistencies and errors in the EN practices can be reduced, and multidisciplinary cooperation and efficiency of nutrition practices can be achieved (49).

In conclusion, in the study, in which the EN practices of nurses working in the critical care areas were evaluated from the perspective of nursing, the current EN practices were found to be performed based on the knowledge and experience of colleagues rather than clinical evidence. Therefore, it was concluded that there is a need to improve the knowledge of ICU nurses on EN practices with different training methods. These results suggest that Turkish ICU nurses need educational interventions focusing on areas such as nutritional risk score assessment, gastric residual volume management, reliable methods to confirm the position of the feeding tube, and drug administration through the feeding tube. Furthermore, institutional and professional improvements should be made that emphasize multidisciplinary cooperation in these practices and support nurses' competence in EN practices. Further studies including multidisciplinary nutritional support are also required to support the current findings.

Strengths and limitations of the study

Since it was the first study evaluating the compliance of enteral feeding practices of nurses working in critical care areas with the guidelines, this study made contributions to the limited literature in this field. Moreover, the fact that some of the findings of this study are similar to the findings of studies conducted with ICU nurses in different countries may contribute to the international literature on institutional and

professional improvements to support nurses' competencies in EN. However, the study has some limitations. First of all, this study was carried out with 196 ICU nurses in the city of Afyonkarahisar located in Turkey's Aegean region. Therefore, the results obtained from this study are limited to this sample. Another limitation is that the data were obtained based on self-reports of the participants, therefore there is the possibility of bias. The nurses' assessment of their EN practices may have differed from their actual situation. Bedside observation of EN practices will be the most objective method. Observational studies that will be planned with a larger sample in the future can evaluate the EN practices of nurses working in the critical care field and the influencing factors more objectively.

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