Original Article

Barriers to enteral feeding of critically ill adults in Korea

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Background and Objectives: Evaluating barriers to provision of enteral nutrition in intensive care units and planning an appropriate intervention can improve nutritional nursing practice in these units. This study aimed to develop a Korean version of the Barriers to Enterally Feeding Critically Ill Patients Questionnaire (BEFIP-K) and to explore the barriers to enteral feeding of critically ill patients in Korea. **Methods and Study Design:** The 24-item BEFIP-K was developed according to the process laid down by the World Health Organization. Its psychometric properties were assessed, including acceptability; validity, which included content validity and construct validity; and reliability, which consisted of internal consistency and item–total correlation, using data from 207 critical care nurses in four tertiary hospitals in South Korea. **Results:** The calculated content validity indices for each item were from 0.88 to 1.00. As for the exploratory factor analysis, 24 items were loaded on five domains, accounting for 56.9% of the total variance. The Cronbach's alpha coefficient of the total scale was 0.913 and the coefficients for item–total correlation analyses ranged from 0.469 to 0.694. The total BEFIP-K score was 32.1, with a range from 18.5 to 45.4. **Conclusions:** The findings support that the BEFIP-K is a feasible, valid instrument for assessing barriers to provision of enteral nutrition.

Key Words: barriers, critical illness, enteral nutrition, questionnaire, validation study

INTRODUCTION

Nutritional support therapy including enteral nutrition (EN) and parenteral nutrition (PN) has been accepted as essential for critically ill patients, who are exposed to complex and diverse metabolic stress and increased catabolism.[1,2] Among these two methods of nutrition provision, EN has been emphasized because it has diverse advantages for critically ill patients over PN.[3] For instance, EN facilitates the provision of appropriate nutritional ingredients, such as protein, vitamins, and minerals, and maintains the integrity of the gastrointestinal tract, decreasing complications such as inflammation.[1,4] In addition, adequate provision of EN results in reduced length of hospital stay and related cost.[3,4] For those reasons, many previous studies have suggested early enteral nutrition, which refers to initiation of EN within 24 hours after admission to the intensive care unit.[2]

Despite the great advantages of EN for critically ill patients, nutritional support practice in intensive care units is often suboptimal. One study reported that critically ill patients received 49.1% of their energy requirements.[5] Another study revealed that only 51% of prescribed EN volume was provided to patients admitted into a medical intensive care unit and that median initiation time for EN was a full 32 hours after admission to the unit.[6]

Due to findings like these, healthcare providers and researchers have made considerable efforts to identify what factors hinder provision of EN in critically ill patients. One of the main reasons for inadequate EN support is that EN is often omitted, delayed, or deprioritized in the face of the need for other critical interventions for critically ill patients.[7,8] Kozeniecki et al[6] found that EN in the medical intensive care unit was often suspended because of extubation, bedside procedures, and radiologic examination, for example. Besides issues of prioritization, patients characteristics such as gender and disease severity,[9] aspects of the healthcare provider such as lack of knowledge about EN,[10,11] and prescribed energy requirements lower than required for patient's body-mass index[12] have been found to be barriers to provision of EN.

Evaluating barriers to provision of EN in intensive care units and planning an appropriate intervention can improve nutritional nursing practice in intensive care units. Given the need to comprehensively assess barriers to provision of EN using a standard, reliable, and valid method, Cahill et al[13] developed the Barrier to Enterally Feeding Critically Ill Patients Questionnaire (BEFIP). The BEFIP was designed to explore barriers in diverse dimensions such as healthcare providers, policies, and resources, and its psychometric properties have been confirmed in previous studies.[13,14] However, the need remains for a well-

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developed, valid scale like the BEFIP to assess barriers to provision of EN in intensive care units in a range of contexts globally, including that of South Korea. Hence, this study aimed (a) to develop a Korean version of the BEFIP (the BEFIP-K), (b) to evaluate the psychometric properties of the BEFIP-K, and thereafter (c) to explore the nature and severity of barriers to provision of EN in intensive care units in South Korea. Identifying the barriers that impact the delivery of EN can contribute to the development of standardized protocols, thereby improving the nutritional intake of critically ill patients.

METHODS
Study design
This study adopted a secondary data analysis method. The original dataset was collected as part of developing and evaluating an enteral nutritional support program for critical care nurses in South Korea.[15] The conceptual diagram was illustrated in Figure 1.

Participants
Using a convenience sampling method, the participants whose data made up the original dataset had been recruited from nine intensive care units for critically ill adults in four tertiary hospitals in South Korea. Critical care nurses who were in charge of provision of EN in those institutions were asked to participate in the original study. Unit manager nurses, who mainly engage in administration or management, were excluded because they were not directly involved in nutritional support. Among 209 nurses initially engaged, two nurses did not complete the pre-test questionnaires in the original study, whose data this secondary data analysis used; thus, the present researchers employed pre-test data from 207 critical care nurses.

Adequate sample size for the psychometric evaluation of a measure is still debatable. Hence, the sample size for this study was estimated based on sample size calculation for exploratory factor analysis. Howard[16] proposed a sample size of five times the number of items or 200, whichever is higher for the exploratory factor analysis. The BEFIP consisted of 26 items, which multiplied by 5 indicates that data of 130 critical care nurses would be necessary. Thus, the sample size of 207 (more than 200) in this secondary data analysis was sufficient for the conditions suggested by Howard.[16]

Instruments
Personal characteristics
In the original study, the participants responded to questions on gender, age in years, intensive care unit type, period of clinical experience as a nurse and as a critical care nurse, educational level, and educational experience related to nutrition for critically ill patients.

Barriers
The barriers to provision of EN in intensive care units were measured with the Barrier to Enterally Feeding Critically Ill Patients Questionnaire (BEFIP).[13,14] This scale was developed based on the knowledge-attitudes-behavior framework and a literature review, and consisted of 26 items categorized into five domains: "(1) guideline recommendations and implementation strategies, (2) delivery of enteral nutrition to the patient, (3) critical care providers' attitudes and behavior, (4) dietitian support, and (5) intensive care unit resources."[14] Each item was responded to on a 7-point Likert-type scale, ranging from 1 for "not at all important" to 7 for "very important." The score was calculated as follows: responses from 1 to 4
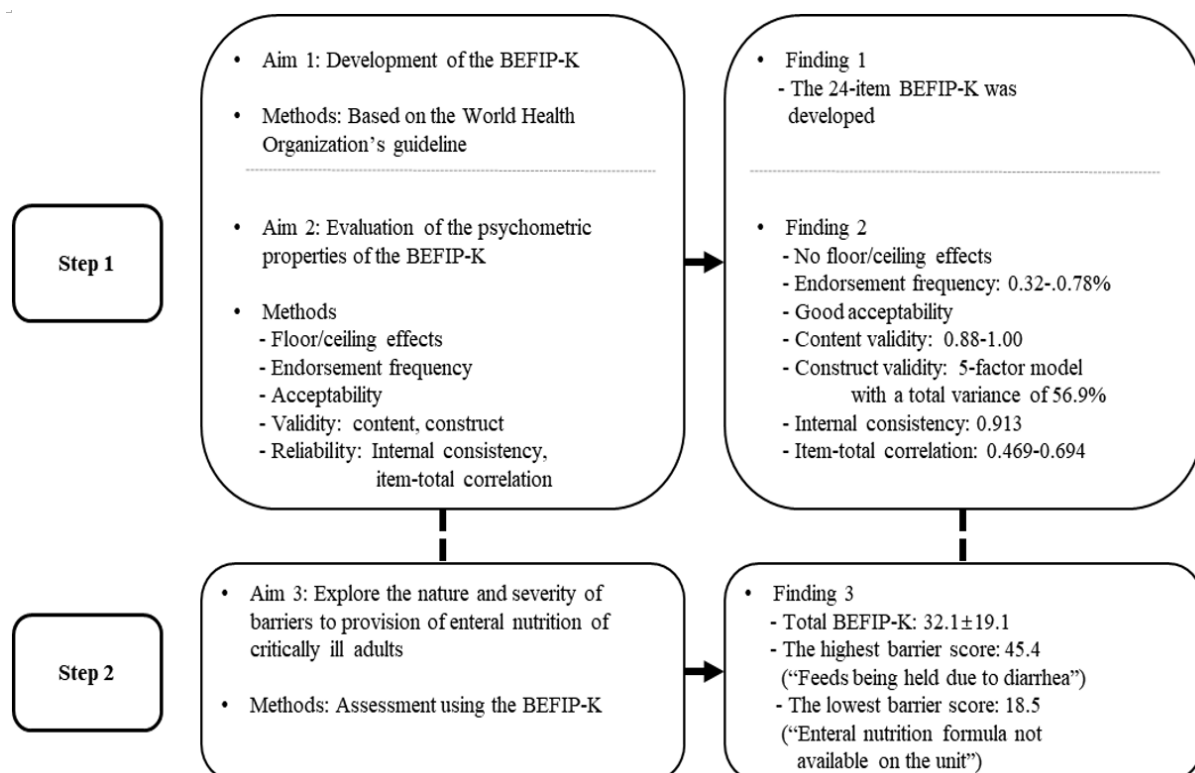
Figure 1. Conceptual diagram of this study. BEFIP-K: Korean version of the barrier to enterally feeding critically ill patients questionnaire.

were scored as zero points whereas responses of 5, 6, and 7 were regarded as 1, 2, and 3 points, respectively. Thereafter, the score for the item was divided by 3 (the largest possible points for each item) and multiplied by 100. The mean score across the 26 items was the total barriers score; a higher score meant greater barriers to provision of EN. In the developmental study, Cronbach's alpha coefficient for the BEFIP was 0.94, while those for its five domains ranged from 0.84 to 0.89.[13] Construct validity was also confirmed by previous studies.[13,14]

Developing the Korean version of the BEFIP

The developmental process for the Korean version of the BEFIP was guided by the World Health Organization (WHO) "process of translation and adaptation of instruments."[17] This process included translation into the target language, review by an expert group, back-translation into the original language, and a pretest with a cognitive interview The translation of the English-based BEFIP into Korean was performed by one of the researchers, who was fluent in English and a native speaker of Korean; then, the original and the translated BEFIP were reviewed and compared to identify inconsistencies and equivalences by an expert group consisting of the researcher who had taken charge of the translation, two critical care nurses who had been working in intensive care units for more than 10 years, and a nursing professor experienced in developing several instruments. The expert group found some minor inconsistencies between the original and the translated BEFIP in areas such as tense and singular/plural; these were solved by discussing. However, the experts also raised the issue of item equivalence, that is, item relevancy in the target culture.[18] Three of 26 items, including two items related to dietitians dedicated to intensive care units ("Dietitian not routinely present on weekday patient rounds", "No or not enough dietitian coverage during evenings weekends and holidays") and one related to small bowel access ("Delays and difficulties in obtaining small bowel access in patients not tolerating enteral nutrition"), did not reflect the environment of intensive care units in South Korea. The researchers, the expert group for reviewing the translated BEFIP, and another expert group which consisted of one intensive care unit manager, one critical care nurse specialist, and one nursing professor, discussed the item equivalence and agreed to merge and reword the two items related to instead ask about the presence of a dietitian for managing enteral nutrition, while the item related to small bowel access was deleted. Then, the preliminary 24-item BEFIP-K was back-translated into the original language, English, by a professional translator who was fluent in Korean and a native speaker of English. The back-translated BEFIP was compared with the original BEFIP to ensure good correspondence of the BEFIP-K. As the last step of the process, a pretest and a cognitive interview were conducted with 10 critical care nurses who were not involved in this study. These nurses spent approximately 10 minutes to complete the BEFIP-K and evaluated the items as low to moderate difficulty to understand.

Ethical considerations

The original dataset used here was gathered after approval from the ethical review board of an institution to which one of the researchers was affiliated (IRB NO. HIRB-2015-004). This secondary data analysis received institutional review board from another institution, to which the other researcher belonged (IRB NO. E1806/002-009).

Data collection

Following the conditions of institutional review board in the original study, researchers contacted nursing departments in four tertiary hospitals that had intensive care units for critically ill adults. After being given permission by the nursing directors, they put up flyers on bulletin boards for recruitment, containing information about the (original) study's purpose, methods, length, potential benefits and risks, and free withdrawal from the study. People who were interested in engaging in the study received the same information again from the researchers and signed an informed consent form.

The original study, including a pretest, a two-week educational intervention, and a posttest, was performed from March to April 2015. For this secondary analysis, the partial data from the pretest were used.

Data analysis

All data, including data on personal characteristics and scores for each item and the total scale, were calculated using descriptive statistics. Then, floor and ceiling effects were assessed by calculating the percentage of the participants' total BEFIP-K scores that were at floor (the lowest possible score of zero) or ceiling (the highest score of 100). When total BEFIP-K score in more than 15% of the participants was zero or 100, this was deemed to show the presence of floor or ceiling effects, respectively.[19] Endorsement frequency of each item was evaluated by exploring the agreement percentage in each item's responses (that is, of "somewhat important," "important," and "very important" responses).[13] Streiner and Norman[18] recommend an endorsement frequency of 0.2 to 0.8 for each item. To evaluate acceptability, the rate of missing responses for each item was calculated. If the item had more than 10% of responses missing, it was considered for deletion.[13]

Validity was assessed using content validity and construct validity. For a content validity index, eight experts, including two advanced practice nurses in critical care, two unit manager nurses in intensive care units for critically ill adults (in two tertiary hospitals where we did not collect data), three nursing professors, and one professor of nutrition, reviewed the 24 items and scored each item from 1 (not relevant) to 4 (highly relevant). The content validity index of each item was recommended to be 0.88 or higher, since the BEFIP-K was evaluated by eight experts.[20] Construct validity was evaluated using exploratory factor analysis (EFA)[21] based on principal component analysis with an orthogonal rotation. Prior to interpreting the EFA, two assumptions, including the Bartlett's test of sphericity and the Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy, were checked. The factor retention method selected the KMO criterion, indicating that factors are selected when eigenvalues are above 1, and the cutoff for factor loading was set above 0.30.[22]

Reliability was assessed in terms of internal consisten-

cy using both Cronbach's alpha coefficients for each domain and the total scores and item–total correlations based on Pearson correlation analyses.[21] In accordance with the suggestion of Nunnally and Bernstein,[23] Cronbach's alphas ranging from 0.7 to 0.9 were considered good internal consistency. In addition, it was decided that correlation coefficients for item–total correlation should be greater than 0.2.[18]

RESULTS
Personal characteristics
Most participants in the current (secondary data) analysis were female (90.3%), and approximately 60% had a bachelor's degree. These critical care nurses' mean age was 29.65 years old, and 58% were currently working in surgical intensive care units. Average period of clinical experiences as a nurse was 85.5±89.2 months while average period of working in intensive care units was 45.2±44.0 months. Among the nurses, 36.7% responded that they had participated in education for enteral nutrition (Table 1).

Evaluation of the psychometric properties of the BEFIP-K
Floor/ceiling effects and endorsement frequency
Among 207 respondents, three (0.96%) reported a total BEFIP-K score of zero and none of 100, indicating no floor or ceiling effects. Endorsement frequency of each item ranged from 0.32% for item 8 ("Enteral nutrition formula not available on the unit") to 0.72% for item 21 ("Feeds being held due to diarrhea") (Table 2).

Acceptability
Seven out of 24 items (items 1, 2, 5, 6, 9, 14, and 24) had missing responses (Table 2). The percentage of missing responses per item ranged from zero to 0.97%, indicating that all 24 items could be included the BEFIP-K.[13]

Validity
The results of content and construct validity tests are described in Tables 3 and 4. The calculated content validity

indices for each item were from 0.88 to 1.00. Given the approximate chi-squared of 1969.539 ($p<0.001$) for Bartlett's test of sphericity and a value of 0.893 for the KMO measure of sampling adequacy, the assumptions for the exploratory factor analysis were satisfied.[16] As a result of the EFA, five domain factors with eigenvalues above 1 were retained, as in the developmental study.[13] Factor 1, which was named "Guideline recommendation and implementation strategies,"[13] consisted of six items and had a variance explained of 33.81%. In factor 2, six items related to "Delivery of enteral nutrition to patients"[13] were loaded, and the variance of this factor was explained as 8.34%. Factors 3, "Critical care provider attitudes and behavior," and 4, "Dietitian support,"[13] respectively included six and three items with variance explained of 5.43% and 5.16%. Finally, factor 5, "intensive care unit resources,"[13] loaded three items and had a variance explained of 4.18%.

Reliability
Internal consistency results are summarized in Table 4. The Cronbach's alpha coefficients of the five domains ranged from 0.599 for "Intensive care unit resources" to 0.834 for "Guideline recommendation and implementation strategies." The alpha coefficient for the total BEFIP score was 0.913.

With respect to the item–total correlation analyses, the coefficients of each item ranged from 0.469 for item 21 to 0.694 for item 12, and all correlational relationships were statistically significant ($p<0.01$).

Barriers to provision of EN
The score range for each item was from 18.5, for item 8 ("Enteral nutrition formula not available on the unit"), to 45.4, for item 21 ("Feeds being held due to diarrhea") (Table 4). Domain scores ranged from 28.5, for domain 1 ("Guideline recommendation and implementation strategies") to 34.4, for domain 4 ("Delivery of enteral nutrition to the patient"). The total BEFIP-K score was 32.1±19.1, with a range from zero to 91.7 (Table 4).

Table 1. Personal characteristics (n=207)

Characteristics	N (%) or mean (SD)	
Gender	20	(9.7)
Male		
Female	187	(90.3)
Highest educational level	75	(36.2)
Diploma		
Bachelors	109	(52.8)
Over master	23	(11.0)
Age, years	29.7	(7.3)
Intensive care unit types	87	(42.0)
Medical		
Surgical	120	(58.0)
Period of clinical experience as a nurse, months	85.5	(89.2)
Period of clinical experience as a critical care nurse, months	45.2	(44.0)
Educational experience related to enteral nutrition	76	(36.7)
Yes		
No	130	(62.8)
Missing	1	(0.5)

SD: standard deviation.

Table 2. The characteristics of participating chefs and cooks (n=90)

Item[†]		Endorsement frequency	Missing (%)
1	Current scientific evidence supporting some nutrition interventions is inadequate to inform practice	0.44	0.48
2	The language of the recommendations of the current guidelines for nutrition are not easy to understand	0.38	0.97
3	I am not familiar with our current guidelines for nutrition in the ICU	0.58	-
4	Current guidelines for nutrition are not readily accessible when I want to refer to them	0.50	-
5	No feeding protocol in place to guide the initiation and progression of enteral nutrition	0.59	0.97
6	Current feeding protocol if outdate	0.43	0.97
7	Not enough nursing staff to deliver adequate nutrition	0.67	-
8	Enteral nutrition formula not available on the unit	0.32	-
9	No or not enough feeding pumps on the unit	0.54	0.48
10	No dietitian for managing enteral nutrition in the unit	0.64	-
11	Waiting for the dietitian to assess the patient	0.48	-
12	There is not enough time dedicated to education and training on how to optimally feed patients	0.61	-
13	No feeding tube in place to start feeding	0.61	-
14	Delay in physicians ordering the initiation of enteral nutrition	0.61	-
15	Waiting for physician/radiology to read x-ray and confirm tube placement	0.50	0.97
16	Delays in initiating motility agents in patients not tolerating enteral nutrition (i.e., high gastric residual volume)	0.65	-
17	In resuscitated, hemodynamically stable patients, other aspects of patient care still take priority over nutrition	0.65	-
18	Needles delays in relaying information regarding the initiation and progression of nutrition	0.53	-
19	Non-ICU physicians (i.g., surgeons, gastroenterologists) requesting patients not be fed enterally	0.48	-
20	Nurses failing to progress feeds as per the feeding protocol	0.56	-
21	Feeds being held due to diarrhea	0.72	-
22	Fear of adverse events due to aggressively feeding patients	0.37	-
23	Feeding being held too far in advance of procedures or operating room visits	0.59	-
24	General belief among ICU team that provision of adequate nutrition does not impact on patient outcome	0.51	0.48
Floor/Ceiling (%)		0.96%/0.0%	

ICU: intensive care unit.
[†]Items except no. 10 was described based on the original BEFIP scale.[13]

DISCUSSION

Although many Korean critical care providers agree on the importance of EN for critically ill adults, it is difficult to adequately provide it due to barriers. Hence, the current study developed and successfully validated a Korean version of the Barrier to Enterally Feeding Critically Ill Patients Questionnaire (BEFIP) and evaluated the barriers to EN of critically ill adults in Korea.

Regarding the development and evaluation of the Korean version of the BEFIP, the analysis for floor and ceiling effects of total score and endorsement frequency of each item were satisfied with the recommendation of McHorney and Tarlov[19] and Streiner and Norman.[18] Based on the BEFIP developmental study by Cahill et al,[13] which used these methods in the item selection process, the current study also adopted them, and showed that the BEFIP-K had no evidence on floor and ceiling effects as well as were in acceptable range of endorsement frequency.

As for acceptability, the current study evaluated the rate of missing responses for each item, and again showed sufficient results for the Korean critical care nurse respondents, though slightly lower than those on the BEFIP developmental study,[13] which reported missing responses in a range from zero to 7.0%. Acceptability of a scale is closely related to high response rate, which indicates the

probable absence of felt burden to complete a scale.[21] However, since critical care nurses completed the BEFIP-K in their free time, it might not really show that there was a low burden.

The findings on the content validity test indicated that all 24 items had content relevance as per Lynn,[20] who provided a content validity cutoff depending on the number of experts: 1.0 for five or fewer experts, whereas an item should not be rated 1 (not relevant) or 2 (somewhat relevant) by more than one of six to ten experts. Hence, the current study set a cutoff of 0.88; the results confirmed that item content on the BEFIP-K was adequate to assess barriers to provision of EN in South Korea.

Although some items differed between the BEFIP-K and the original BEFIP, the exploratory factor analysis findings on retained factors and loaded items in this study are consistent with the BEFIP developmental study.[13] This might be because the original BEFIP was developed on a theoretical basis. A clearly described theory could help conceptualize the phenomenon one wants to know about as well as generate appropriate items that reflect that phenomenon.[24,25] Cahill et al[13] described the five factors of the original BEFIP on the theoretical basis of a "framework for adherence to clinical practice guidelines in the intensive care unit."[26] Since this framework deal with the common concepts related to intensive care units,

Table 3. Results of the explanatory factor analysis[§] (n=207)

Item[†]	Factor 1[‡]	Factor 2[‡]	Factor 3[‡]	Factor 4[‡]	Factor 5[‡]
1 Current scientific evidence supporting some nutrition interventions is inadequate to inform practice	0.663				
2 The language of the recommendations of the current guidelines for nutrition are not easy to understand	0.725				
3 I am not familiar with our current guidelines for nutrition in the ICU	0.727				
4 Current guidelines for nutrition are not readily accessible when I want to refer to them	0.641				
5 No feeding protocol in place to guide the initiation and progression of enteral nutrition	0.632				
6 Current feeding protocol if outdate	0.634				
7 Not enough nursing staff to deliver adequate nutrition					0.445
8 Enteral nutrition formula not available on the unit					0.736
9 No or not enough feeding pumps on the unit					0.487
10 No dietitian for managing enteral nutrition in the unit				0.669	
11 Waiting for the dietitian to assess the patient				0.756	
12 There is not enough time dedicated to education and training on how to optimally feed patients				0.611	
13 No feeding tube in place to start feeding		0.810			
14 Delay in physicians ordering the initiation of enteral nutrition		0.771			
15 Waiting for physician/radiology to read x-ray and confirm tube placement		0.721			
16 Delays in initiating motility agents in patients not tolerating enteral nutrition (i.e., high gastric residual volume)		0.612			
17 In resuscitated, hemodynamically stable patients, other aspects of patient care still take priority over nutrition		0.365			
18 Needles delays in relaying information regarding the initiation and progression of nutrition		0.364			
19 Non-ICU physicians (i.g., surgeons, gastroenterologists) requesting patients not be fed enterally			0.550		
20 Nurses failing to progress feeds as per the feeding protocol			0.531		
21 Feeds being held due to diarrhea			0.559		
22 Fear of adverse events due to aggressively feeding patients			0.446		
23 Feeding being held too far in advance of procedures or operating room visits			0.615		
24 General belief among ICU team that provision of adequate nutrition does not impact on patient outcome			0.689		
Initial eigenvalues	8.115	2.000	1.305	1.237	1.003
Explained variance after rotation (%)	33.8	8.3	5.4	5.2	4.2
Cumulative explained variance after rotation (%)	33.8	42.2	47.6	52.7	56.9

ICU: intensive care unit; BEFIP: barrier to enterally feeding critically ill patients questionnaire.

[†]Items except no. 10 were described based on the original BEFIP scale[13].

[‡]Factor names were "Guideline recommendation and implementation strategies" for factor 1, "Delivery of enteral nutrition to patients" for factor 2, "Critical care provider attitudes and behavior" for factor 3, "Dietitian support" for factor 4, and "Intensive care unit resources" for factor 5, and were described base on the original BEFIP scale[13].

[§]Principal axis factoring with an orthogonal rotation.

Table 4. Results of the score, content validity, and internal consistency (n=207)

Item No.	Item score[‡]	Content validity index	Item-total correlation, r	Cronbach's α
Domain 1. "Guideline recommendation and implementation strategies" (score: 28.5)				0.834
1	25.0	1.00	0.567[**]	
2	20.3	1.00	0.499[**]	
3	34.6	1.00	0.475[**]	
4	28.7	1.00	0.637[**]	
5	37.8	1.00	0.681[**]	
6	24.5	1.00	0.612[**]	
Domain 2. "Intensive care unit resources" (score: 31.5)				0.599
7	42.0	1.00	0.470[**]	
8	18.5	0.88	0.541[**]	
9	34.1	1.00	0.529[**]	
Domain 3. "Dietitian support" (score: 33.4)				0.755
10	40.3	0.88	0.586[**]	
11	25.3	0.88	0.600[**]	
12	34.6	1.00	0.694[**]	
Domain 4. "Delivery of enteral nutrition to the patient" (score: 34.4)				0.821
13	38.6	1.00	0.518[**]	
14	37.4	1.00	0.641[**]	
15	29.0	0.88	0.558[**]	
16	40.1	0.88	0.715[**]	
17	31.7	1.00	0.511[**]	
18	29.8	0.88	0.574[**]	
Domain 5. "Critical care provider attitudes and behavior" (score: 31.9)				0.768
19	27.1	0.88	0.622[**]	
20	32.2	1.00	0.653[**]	
21	45.4	0.88	0.469[**]	
22	19.8	0.88	0.472[**]	
23	36.6	1.00	0.634[**]	
24	30.1	1.00	0.577[**]	
Total BEFIP-K score (range)	32.1±19.1 (0 to 91.7)			0.913

BEFIP-K: Korean version of the barrier to enterally feeding critically ill patients questionnaire.
[†]The names of each domain that were identified from the exploratory factor analysis were described based on the original BEFIP scale[13] (please show where this symbol should be in the table).
[‡]The possible scores of both each item and total BEFIP-K ranged zero to 100.
[**]$p<0.01$.

regardless of geographical domain, it is unsurprising that the BEFIP-K would have the same factor structure.

The alpha coefficients of both the total BEFIP-K scale and four out of five domains indicated good internal consistency.[23] However, domain 2, named "Intensive care unit resources," had a relatively low coefficient. This might be partially due to heterogeneity of item content. Even though each of the items on nursing staff, nutrition formula, and feeding pumps seems clearly related to required resources to provide EN in intensive care units, the other aspects might have slightly different attributes. However, correlation coefficients for item–total correlation, which is the other statistical method for assessing internal consistency,[21] were satisfied according to Streiner and Norman.[18] Overall, internal consistency of the BEFIP-K was found adequate to assess barriers to provision of EN in South Korea.

The findings from respondents' BEFIP-K scores indicated that they perceived higher barriers to provision of EN compared with those suggested for other countries in the BEFIP validation study.[14] Cahill et al[14] investigated barriers to provision of EN for 1,439 critical care nurses at 55 intensive care units in Asia (but not South Korea),

Australia, New Zealand, Canada, the United States, and Europe; total BEFIP score ranged from 18 for the United States to 29 for Asia. Based on the findings of both the current study and Cahill et al,[14] we may tentatively assume nationally specific factors such as healthcare environments, might have an effect on provision of EN for critically ill patients.

In this study, critical care nurses reported that the most important barrier to enteral feeding was "Feeds being held due to diarrhea". Gastrointestinal intolerance including diarrhea was a frequent cause for interruptions of EN in a systematic review study of Kim et al.[9] Therefore, it is required to monitor patient's gastrointestinal function and medication, and to strictly follow a standard precaution to avoid bacterial contamination during administration of EN. The adjustment of concentration and infusion rate of enteral formula may contribute to decreasing diarrhea due to hyper-osmolality, thereby may prevent unnecessary interruptions of EN.

When interpreting the results of the current study, several potential limitations should be taken into consideration. First, as disclosed in the method section, the current study involved secondary data analysis, so that the sample

size was prearranged. However, as the sample size of the current study satisfied the stipulations of Howard,[16] the exploratory factor analysis seems to have been adequate. Second, the original dataset was made using a convenience sampling method in tertiary hospitals. Such sampling methods might cause bias related to representation. Finally, although the evidence we have supports the validity of the tool, we could not apply some kinds of psychometric evaluation, such as for test–rest reliability and convergent and discriminant validity.[18,24]

Conclusions

In conclusion, the current study confirmed the availability of the BEFIP-K for critical care nurses in South Korea. Some recommendations for clinical practice and future research can be made based on current study. First of all, barriers to provision of EN need to be accurately assessed in order to provide tailored intervention to critical care nurses. In addition, nursing managers in in intensive care units should be aware of the barriers that apply in their own contexts. Future research should conduct additional psychometric evaluations on matters such as test–retest reliability and convergent and discriminant validity using data from diverse types of intensive care units.

AUTHOR DISCLOSURES

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