



Palestinian nurses' knowledge, attitudes, and practices regarding enteral nutrition: Cross-sectional study

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ABSTRACT

Background: Enteral nutrition support plays a key role in minimizing malnutrition in critically-ill patients, and its provision is originally a nurse's responsibility. Thus, nurses need to have a sufficient knowledge and a positive attitude with regard to enteral nutrition. In Palestine, literature regarding nurses' knowledge, practices, and attitudes of enteral nutrition is rare.

Objective: This study aimed to investigate Palestinian nurses' knowledge, practices, and attitudes regarding enteral nutrition.

Method: Interview based pre-tested questionnaire was used during data collection procedure. Cronbach Alpha was also used to determine the reliability of knowledge, attitude and practice questionnaire. Descriptive statistics, independent *t*-test, and ANOVA were performed.

Results: A total of 325 registered nurses were involved in the final analysis. The mean of the knowledge score is (9.6 ± 2.8) out of 20. It was confirmed that sociodemographic characteristics has no influence on nutrition knowledge score among nurses. The findings also reveal that certain aspects of enteral nutrition practices were consistent with the current guidelines such as flushing the tube and backrest elevation. On the other hand, certain practices showed inconsistency and differences with international guidelines such as checking gastric residual volume. Results also showed that nurses attitudes were positive towards enteral nutrition.

Conclusion: It was found that nurses' have inadequate knowledge regarding enteral nutrition. The findings also showed that enteral nutrition practices among nurses were somewhat incongruent with best current evidence. However, it was noted that they have positive attitudes towards enteral nutrition. Promoting research utilization is highly needed as well as establishing evidence-based guidelines.

1. Introduction

Various reports have found that malnutrition is a widespread health problem in hospitalized patient probably because of misunderstanding of nutritional needs (Kim & Choi-Kwon, 2011). Ros et al. (2009) mentioned the factors that may have took a part in the exacerbation of malnutrition status including; delaying the onset of enteral feeding, underestimating protein and energy requirements, and other factors linked to the delivery of feeding such as inappropriate administration of gastric residual volume and long fasting time (Ros et al., 2009). Therefore, enteral nutrition (EN) is crucial routine to better the nutritional status of critically-ill patient's nutritional residing in the intensive care

unit (ICU) (McClave et al., 2009).

Former literature has shown that enteral nutrition can ameliorate wound healing (Drover et al., 2010), maintain the gastrointestinal tract (GIT) function, minimize the rates of complications and period of hospital stay (Moreira & McQuiggan, 2009), and decrease length of mechanical ventilation and the rates of mortality (Gupta et al., 2012).

Recent guidelines recommend head-of-bed (HOB) elevation of 30°-45° to avoid pneumonia and aspiration, unless contraindicated for some medical conditions such as; hemodynamic instability, certain surgical operations (e.g., central venous catheter insertion), an unstable spine, and prone positioning (Bankhead et al., 2009).

More than 100 enteral formulas are presently available in the

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markets. These formulas are considered necessary for the patient utilizing a tube feeding or following an oral liquid diet for over a few days. Several enteral products (e.g., Ensure, Ensure Plus, and Boost) are present in a powdered form or in a ready-to-drink liquid form (Rolfes et al., 2017).

Enteral formulas are assorted based on their macronutrient source into (1) standard which contain intact polysaccharides and protein, (2) elemental which contain broken down macronutrients; or (3) specialized which is designed for specific diseases. A wide variety of formulas are available in each of these classes. Additionally, there is a type of formulas, called blenderized formula, made from whole ingredients and derive their protein mainly from pureed poultry or meat. Selection of an enteral formula depends on the patients' clinical condition, his nutrient requirements, and his gastrointestinal tract function (Cde & Csg, 2016).

Enteral nutrition usually needs drug delivery through the same feeding tube. However, attention should be considered to prevent potential diet-drug interaction, and tube blockage. Thus, guidelines encourage nurses to halt feeding 15 min prior and 15 min post medication administration, and to flush the tube with a minimum of 15 ml water. Subsequently nurses should dilute the liquid or solid drug as needed (Bankhead et al., 2009).

In vast majority of patients, aspiration can produce severe complications including pneumonia and hypoxia. Several reasons can result in aspiration including the existence and size of nasogastric tube, sedation, supine patient positioning, malposition of tube feeding, bolus feeding delivery methods, mechanical ventilation, and many more causes (Chen et al., 2015). Checking the gastric residual volume is one method used to avoid aspiration. Research towards the efficiency of this method has provided incompatible outcomes. Therefore, no sufficient studies manifested that gastric residual volume is correlated with aspiration pneumonia. Furthermore, recent studies did not find that a high gastric volume values are an indication for elevated risk of aspiration pneumonia (Kattelmann et al., 2006).

Enteral nutrition is sometimes associated with complications. For example, tube obstruction is one of the most known complications of enteral nutrition and medication administration. Therefore, nurses should act proactively by flushing the nasogastric tube to avoid tube obstruction (Bodoky & Kent-Smith, 2009).

Registered nurses (RNs) have a chief role in applying the nutritional care process for critically-ill patients, including calculating daily calorie requirements, and advocating for early enteral nutrition (Fulbrook et al., 2007). When administering tube feeding, the registered nurses are often responsible for maintaining and inserting the tube, delivering the feeds, avoiding and uncover complications associated with enteral nutrition (Metin et al., 2020). The interruptions associated with feeding can be minimized by assessing patient carefully and analyzing the interruption (Stechmiller et al., 1994).

The effective administration of enteral feeding is usually restricted by insufficient nurse knowledge (Cahill et al., 2012; Wentzel Persenius et al., 2009). Primary knowledge and nursing practices towards enteral nutrition can vary not only from one institute to another but also within the same institute (Wentzel Persenius et al., 2006). To our knowledge, no studies have assessed nurses' knowledge, practices, and attitudes in Palestinian hospitals. Therefore, the main purposes of this study were to examine (1) nurses' practices and knowledge focusing on enteral nutrition and (2) nurses' attitudes regarding enteral feeding.

2. Methodology

2.1. Study design and setting

Across sectional study was conducted in six governmental and private hospitals in West Bank, Palestine including (Al-Ahli Hospital, Princess Alia Governmental Hospital, Palestinian Medical Complex, Istishari Arab Hospital, An-Najah National University hospital, and Rafidia Surgical Hospital). The data was collected from the registered

nurses who are employed in the aforementioned hospitals. The nurses from different wards were invited to join the study and they were briefed about the required data and study objectives, Nurses who agreed and signed the written consent form were included in the study. Data was collected over a 5 months, collection started on May 2020 and ended on October 2020. The study protocol was approved by the Deanship of Scientific Research Ethical Committee at Palestine Polytechnic University Committee.

2.2. Sample size and sampling techniques

The sample size was estimated depending on the number of registered nurses in each hospital. G power software for sample size calculation was used; at alpha level of 0.05 with 5% margin of error and 80% confidence level. The sampling method used in the study is purposive sampling in hospitals selection, while simple random sampling in nurses invitation in each hospital (Lohr, 2010).

2.3. Inclusion and exclusion criteria

In the current study, nurses were included if they fit with the following criteria: participants had to be: (1) fluent in Arabic and English languages, (2) working as a registered nurse. While the exclusion criteria included the following conditions; (1) foreign nurses, (2) nurses with work experience less than 6 months, (3) incomplete questionnaires, (4) and volunteer nurses.

2.4. Data collection

Interview based pre-tested structured questionnaire was administered to registered nurses at six Palestinian hospitals. Data collection started on May 2020 and ended on October 2020. Incomplete questionnaires were excluded from the analysis.

2.5. Questionnaire development

Interview based pre-tested structured questionnaire containing a Likert-scale questions, multiple choice questions, and open-ended questions was developed after reviewing previous published papers towards knowledge, attitudes and practices of enteral nutrition education among nurses (Darawad et al., 2015; Morphet et al., 2016). The first draft of the questionnaire was developed by two researchers who are expert of the field and it consisted of fifty-one questions. The questions were divided into five sections: (1) demographics, (2) sources of enteral nutrition information, (3) knowledge of enteral nutrition information, (4) attitudes regarding enteral nutrition, (5) practices regarding enteral nutrition. The questionnaire initially was developed in English then translated to Arabic by official English-Arabic translators. Face validity was done by sending the questionnaire to an expert reference group consisting of medical staff (n = 3), and assessment experts (n = 2), and nutritionist (n = 3). The questionnaire was then pilot tested by twenty nurses who did not take part in the current study.

2.6. Data analysis

The statistical analysis was done using the statistical package for the social sciences SPSS version 21. Continuous variables were assessed for normality of distribution graphically and via the Shapiro-Wilk Test. Descriptive analysis including the means and standard deviation were used to analyze continuous variables, while categorical variables were described in percentages and frequencies. Cronbach Alpha was also used to determine the reliability of the developed questionnaire. The inferential statistical tests were used according to the variables and number of groups. Independent *t*-test and one-way ANOVA test was used to determine the association between selected variables (e.g., demographic data and knowledge score). Chi-square test was used to determine the

association between categorical variables.

3. Results

3.1. Nurses' recruitment

Fig. 1 shows the nurses recruitment steps. A total of 325 registered nurses were included in the final analysis. Only nineteen nurses had been excluded from the study due to missing data.

3.2. Nurses' sociodemographic

Nurses' characteristics are summarized in Table 1. Nurses were almost equally distributed among males (n = 155) and females (n = 155) and males (n = 183). The mean age of the nurses was 28.27 ± 6.3 years, ranged from 20 to 62 years old. Participated nurses belong to six hospitals in west-bank region/Palestine. The majority of the nurses have bachelor degree (76.7%). Most of the nurses were married (59.4%). The analysis also reveals that nearly half of the nurses (56.0%) were living in the villages.

The majority of the nurses (38.2%) were working in intensive care units, 23.7% in the surgery units, and 14.1% in general medicine units, and only 8 nurses (2.2%) were working in gynecology units. Nearly half of participated nurses (46.2%) had an experience level between 1 and 5 years. Whereas only (5.8%) of nurses had a level of experience in nursing greater than 15 years.

3.3. General enteral nutrition practices

The analysis revealed that 65.8 of enrolled nurses have experience in enteral nutrition and 40.9% of them deal with tube feeding patients on a regular day basis. Fig. 1 illustrates that enteral nutrition was most commonly administrated as a bolus feeding by 31.4%. Although it is found that almost half of the nurses (55.4%) had received enteral nutrition related during their study period, the majority of them (67.1%) didn't take a part in-service training after their study period whereas after their study. The statistical analysis also revealed that the internet (63.7%) was the most used source to obtain knowledge of enteral nutrition, while only (15.7%) of participated nurses get enteral nutrition-related information from a dietitian. Moreover, nurses reported that university course (58.5%) was their main source of nutrition knowledge, followed by experience (57.2%), then internet by (45.2%). The workshops (9.8%) and seminars (4.6%) were the least indicated

sources of nutritional information (Table 2).

3.4. Nurses' attitudes

The results indicated that (70.8%) of participants agreed that the complications of enteral feeding are less than parenteral feeding, and (29.2%) of the participant agree that tube feeding is an expensive treatment and it does not have any impacts and benefits for critically ill patients. Most of the participants (66.5%) believe that enteral feeding is a safe way to feed in cases where oral feeding is contraindicated. About (46.2%) consider that EN increases the burden on nursing personnel. Moreover, it is found that nearly a half of nurses (43.1%) think that it is better to avoid enteral feeding because it leads to complications, and most of them (67.4%) think that the nurses have a role in providing adequate nutrition. More details about nurses' attitudes can be found in Table 3. It was also found that there is no relationship between gender and nurses' attitudes regarding enteral nutrition (p > 0.05) (Fig. 2).

3.5. Nurses' practices regarding EN

Table 4 showed that the majority of nurses (69.5%) flushed the tube with 5 cm³ water after feeding. The most used formula was standard formula by (49.5%), followed by specialized formula (38.5%), and only 12% of nurses used Blenderized formula. The results also showed that 44.3% of nurses returned the patient to the original position after feeding. It was also found that three-quarter of nurses (75.7%) check residual volume. The majority of nurses (74.5%) reported that they elevate the patient head position 45° after feeding. Moreover, it was revealed that only 17.2% of nurses didn't give medications during feeding. In regard to the last step in nasogastric tube feeding, 28.9% of nurses auscultate tube placement & check pH, 28.6 of nurses re-flush the tube with water, 27.4 of nurses flush the tube with water, and 15.1% of nurses access for bowel sounds. Furthermore, it was noted that the following practice (return the patient to the original position after feeding) was significantly associated with nurses' gender.

3.6. Knowledge score

The findings showed that the majority of nurses (72.6%) replied correctly to fourth question "Intermittent drip-feeding regimen can be given by pump or gravity drip", followed by (70.8%) to the twelfth question "Enteral tubes should be flushed with 5–20 ml of water". Whereas the fifteenth statement "The ongoing assessment of nasogastric

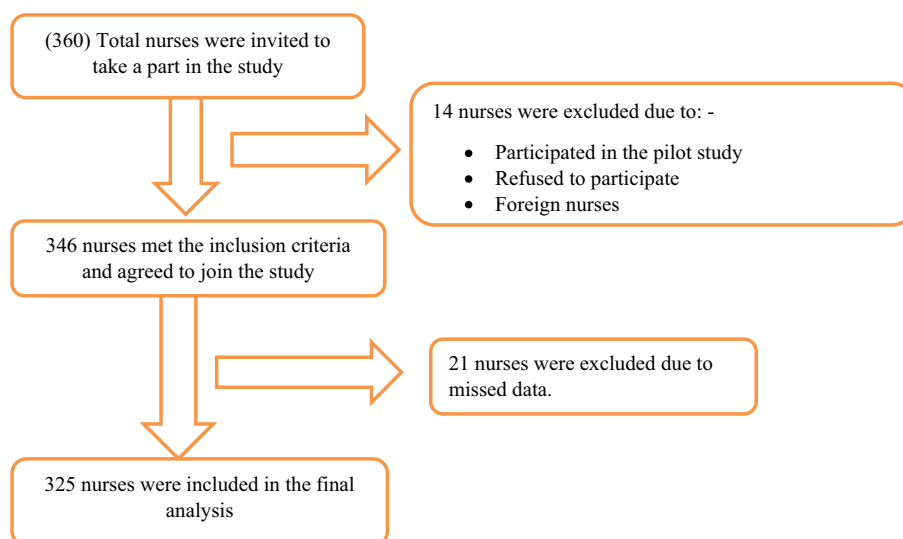


Fig. 1. Registered nurses recruitment flow chart.

Table 1
Nurses' socio-demographic and work-related characteristics according to gender.

Variables		Males (n = 170)		Females (n = 155)		Total	
		n	%	n	%	n	%
Marital status	Single	60	35.3	66	42.6	126	38.8
	Married	110	64.7	83	53.5	193	59.4
	Divorced	0	0.0	5	3.2	5	1.5
	Widow	0	0.0	1	0.6	1	0.3
Educational level	Diploma degree	19	11.2	30	11.4	49	15.1
	Bachelor degree	132	77.6	117	75.5	249	76.6
	Master degree	19	11.2	8	5.2	27	8.3
Area of living	Camp	10	5.9	13	8.4	23	7.1
	Village	96	56.5	86	55.5	182	56.0
	City	46	37.6	56	36.1	120	36.9
Employed unit	Surgery	42	24.7	35	22.6	77	23.7
	General medicine	27	15.9	20	12.9	47	14.5
	Gynecology	1	0.6	6	3.9	7	2.2
	Intensive care	66	38.8	58	37.4	124	38.2
	Paediatric	14	8.2	26	16.8	40	12.3
	Emergency	20	11.8	10	6.5	30	9.2
Years of experience in nursing profession	6 months-<1 year	15	8.8	30	19.4	45	13.8
	1-5 years	81	47.6	69	44.5	150	46.2
	6-10 years	42	24.7	33	21.3	75	23.1
	11-15 years	11.8	12	10.3	7	11.1	19.0
	>15 years	12	7.1	7	4.5	19	5.8

Table 2
General enteral nutrition practices.

Variables		Males (n = 170)		Females (n = 155)		Total	
		n	%	n	%	n	%
Information sources of EN	Books	61	35.9	60	38.7	121	37.2
	Internet	109	64.1	98	63.2	207	63.7
	Doctor	55	32.4	59	38.1	114	35.1
	Dietitian	35	20.6	16	10.3	51	15.7
	Colleagues	37	21.8	41	26.5	78	24.0
Main sources of nutritional information ^a	University course	92	54.1	98	63.2	190	58.5
	Experience	106	62.4	80	51.6	186	57.2
	Seminars	9	5.3	6	3.9	15	4.6
	Workshops	20	11.8	12	7.7	32	9.8
EN-related education in nursing program	Yes	77	45.3	70	45.2	147	45.2
	No	101	59.4	79	51.0	180	55.4
EN-related in-service training program	Yes	69	40.6	76	49.0	145	44.6
	No	63	37.1	44	28.4	107	32.9
	No	107	62.9	111	71.6	218	67.1

EN: enteral nutrition.

^a Responses with more than one selection.

tube placement every ____” get the highest percentage of wrong answers, where only 22.8% of nurses have responded correctly to the statement. Detailed results related to nutrition knowledge score is shown in Table 5. Although it is not shown in a specific table, it was found that socio-demographic characteristics were not statistically associated with nurses' knowledge score (p > 0.05). Furthermore, it was found that nurses' knowledge score is associated with nurses' attitudes (p < 0.05) as illustrated in Table 6. Moreover, Table 7 shows that nurses' knowledge score is related to certain nurses' practices.

4. Discussion

The current study was performed originally to highlight nurses' knowledge, attitudes, and practices regarding enteral nutrition, and to verify whether nurses' knowledge is correlated with nurses' attitudes and practices. Based on the current literature, this is the first research that explored nurses' knowledge, attitudes, and practices regarding enteral nutrition in Palestine, therefore provides essential information to

instruct other interventional and educational programs in this field.

4.1. Nurses' knowledge and practices regarding enteral nutrition

It was observed that the mean knowledge score, which was (9.6 ± 2.8) out of 20, among nurses was inadequate. This finding was consistent with former studies performed by Morphet et al. (2016), Ramuada (2017), and Darawad et al. (2015) who also found a significant lack of nurses' knowledge regarding enteral nutrition, since it was found that 60.1% of nurses have a good knowledge while only 10.3% of nurses have an excellent knowledge level.

Unlike former research which found that females and unmarried nurses are more likely to have above average level of knowledge (Das et al., 2014), we have observed that nurses' marital status and gender isn't correlated with nurses' knowledge score. We further did not find any significant correlation between nurses' knowledge and educational level, and area of living, and this result is consistent with a study conducted by Das et al. (2014).

We have found that the main areas of knowledge deficits regarding enteral nutrition among nurses, as confirmed by lower than 50% of the enrolled nurses answering the knowledge questions correctly, were the following; (1) the differences between enteral products (Ensure vs Ensure Plus), (2) pancreatitis is an indication to start enteral nutrition, (3) when the bed position can be changed, (4) administrating medications, (5) when to flush the tubes, and (6) blenderized tube feeding is contraindicated for immune-compromised patients.

Intragastric feedings (e.g., nasogastric) are preferred over intestinal feedings (e.g., nasojejunal and nasoduodenal). It is documented that intragastric feedings are more easily afforded and less intricate to transfer compared to intestinal feedings since the stomach controls the rate at which nutrients get in the intestine (Cde & Csg, 2016). In this study, however, about half of participated nurses (54%) did not know that know intragastric feeding provides greater physiologic benefits compare to other types of feeding.

Postponing the administration of the enteral feeding was the leading cause of underfeeding (Reid, 2006). Current evidence confirms that early administration of enteral feeding is advantageous for patients undergoing gastrointestinal surgery (Andersen et al., 2011), as well as patients suffering from pancreatitis (Al-Omran et al., 2010). Of note is that 38.2% of participated nurses in this study were percipient of this guideline.

It was also very surprising that a large proportion of nurses did not

Table 3
Nurses' attitudes regarding EN according to gender.

Variables		Males (n = 170)		Females (n = 155)		p-Value
		n	%	n	%	
The complications of enteral feeding are less than parenteral feeding.	Agree	128	75.3	102	65.8	0.165*
	Disagree	29	17.1	38	24.5	
	No opinion	13	7.6	15	9.7	
Enteral feeding is a safe way to feed in cases where oral feeding is contraindicated.	Agree	117	68.8	99	63.9	0.530
	Disagree	37	21.8	36	23.2	
	No opinion	16	9.4	20	12.9	
Enteral feeding increases the burden on nursing personnel.	Agree	76	44.7	74	47.7	0.856
	Disagree	55	32.4	48	31.0	
	No opinion	39	22.9	33	21.3	
It is better to avoid enteral feeding because it leads to complications such as aspiration.	Agree	77	45.3	63	40.6	0.699
	Disagree	65	38.2	64	41.3	
	No opinion	28	16.5	28	18.1	
I think that the nurses have a role in providing adequate nutrition.	Agree	118	69.4	101	65.2	0.331
	Disagree	35	20.6	30	19.4	
	No opinion	17	10.0	24	15.5	
It is important to understand how to administer the tube feeding	Agree	120	70.6	104	67.1	0.618
	Disagree	29	17.1	26	16.8	
	No opinion	21	12.4	25	16.1	
Tube feeding is an expensive treatment and it does not have any impacts and benefits for critically ill patients.	Agree	51	30.0	44	28.4	0.949
	Disagree	85	50.0	79	51.0	
	No opinion	34	20.0	32	20.6	
I am generally satisfied with the quality of enteral feeding given for hospitalized patients.	Agree	90	52.9	80	51.6	0.921
	Disagree	49	28.8	44	28.4	
	No opinion	31	18.2	31	20.0	
I think that It is difficult to administer tube feeding because limited instruction is provided by the Dietitian.	Agree	71	41.8	60	38.7	0.377
	Disagree	72	42.4	61	39.4	
	No opinion	27	15.9	34	21.9	
I think that complications of enteral feeding can be controlled by different practices or different regimens.	Agree	98	57.6	95	61.3	0.761
	Disagree	38	22.4	30	19.4	
	No opinion	34	20.0	30	19.4	

EN: enteral nutrition.

* p < 0.05 using Pearson Chi square.

know that Ensure provides 250 cal and 9 g protein whereas ensure plus provides 350 cal and 13 g protein per serving.

Blenderized formula should not be used in the following cases; (a) if fluid is restricted for lower than 900 ml/day, (b) for patients suffering from food allergies, (c) in case of utilizing a jejunostomy tube, (d) for continuous feeding unless the formula hangs for a maximum of 2 h, (e) and immunocompromised patients (Novak et al., 2009). It is troubling to note that in the current study, 64.0% of participants could know that blenderized formula is prohibited for immunocompromised patients.

In the current study, the vast majority of nurses informed that they kept patients at a backrest elevation of 45° while feeding them. Miller et al. (2008) noticed that the most patients were placed at a backrest elevation lower than 30°. Nonetheless, in the view of the fact that this study used a self-administered questionnaire through data collection process, there is a probability for bias in reporting nurses' practice. Furthermore, a high percentage of the enrolled nurses reported that they return the patient to his original position after feeding them.

Tube clogging is considered one of the most known complications of enteral feeding (Bodoky & Kent-Smith, 2009), therefore it is recommended to flush the tubes on a routine basis with 20 to 30 ml of warm water prior and post every feeding and almost every 4 h when feedings

are continued throughout the day (Bankhead et al., 2009). In this study, the majority of nurses reported that they flushed the tube with 5 cm³ water.

The findings also showed that a high percentage of nurses administer drugs to patients. It is very essential to be cautious while administering drugs through the tubes in order to prevent tube blockage, high drug toxicity, low drug efficacy.

There is a wide controversy towards the value of gastric residual volume as an index of enteral nutrition tolerance. Monitoring gastric residual volume does not mean that patients are protected from aspiration. Gastric residual volume does not have to be measured orderly for patients who are settled on a feeding regimen nor for patients who are using a tube feeding on long-term basis. The preferable ways for minimizing the risk of aspiration include continuous subglottic suctioning, oral decontamination, and elevation of the head of the bed (Bankhead et al., 2009). In the current study, a large percentage of nurses reported that they check gastric residual volume on a regular basis.

4.2. Nurses' attitudes regarding enteral nutrition

In the present study, a large percentage of enrolled nurses (70.7%) believed that the complications of enteral feeding are less than parenteral feeding. Former research indicated that persistent supply of nutrition to the gut can assist in reducing endotoxin translocation, avoiding mucosal atrophy, and maintaining gut barrier function, which may be affected negatively compromised in patients taking total parenteral nutrition (Kudsk et al., 1992). Overall, nurses have positive attitudes towards enteral nutrition. In the current study 50.5% of nurses believe that enteral nutrition is an expensive treatment. Nearly (40.3%) of nurses also believe that enteral nutrition is difficult to administer, this finding goes in line with a former study where 67.2% of nurses reported that enteral nutrition is easy to administer (Ramuada, 2017).

Nonetheless, nearly half of the nurses (46.2%) found that enteral nutrition can increase the workload. This finding is inconsistent with a former study conducted by Ramuada (2017). Surprisingly, the vast majority of nurses (67.3%) believe that nurses provide adequate nutrition support.

4.3. Implications and recommendations

It is very obvious that there is a need for evidence-based guidelines, employing dietitians and nutritionists in hospitals, and a multidisciplinary approach for enteral nutrition strategy. It is highly recommended to improve nurses' knowledge regarding enteral nutrition through conducting training courses in the field of gastric tube feeding informing the nurses of the important points that they need to consider to maintain the correct nutrition for the patients. Also it is recommended to enhance the nurses' accessibility to international guidelines, scientific journals and seminars. Furthermore, there is a necessity for refreshment programs in order to upgrade nurses' practices.

The vast majority of participated nurses have a bachelor of science in nursing. Therefore, nursing colleges need to pay attention to the inclusion of specialized courses of tube feedings within the curricula of the colleges. Moreover nursing colleges need to concentrate their education strategies on the latest evidence-based nursing practices. Besides, a periodic review of nurses' knowledge, and establishing a protocol that will guide nurses' practices regarding enteral nutrition is urgently needed. Future studies addressing nurses' knowledge, attitudes, and practices regarding enteral nutrition in Palestinian hospitals will be necessary.

4.4. Limitations

There are a few limitations in the current study. Firstly; there is no validated and reliable questionnaire in the Arabic language to assess nurses' knowledge, practices, and attitudes. Thus, we developed a new questionnaire with these goals. Secondly, we used self-reporting

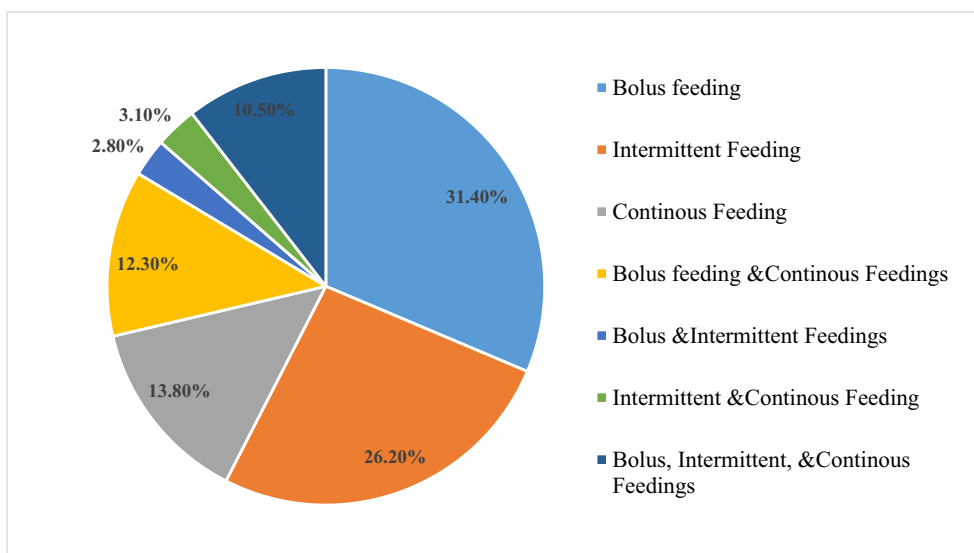


Fig. 2. Delivery route used by nurses.

Table 4
Nurses' practices regarding EN according to gender.

Variables		Males (n = 170)		Females (n = 155)		p-Value
		n	%	n	%	
Dealt with EN patient	Yes	127	74.7	95	61.3	0.010*
	Sometimes	14	8.2	29	18.7	
	No	29	17.1	31	20.0	
Flush the tube with 5 cm ³ water after feeding	Yes	125	73.5	101	65.2	0.088
	Sometimes	9	5.3	18	11.6	
	No	36	21.2	36	23.2	
Give medication for the patient	Yes	127	74.4	116	74.8	0.955
	Sometimes	13	7.6	13	8.4	
	No	30	17.6	26	16.8	
Check residual volume	Yes	125	73.5	121	78.1	0.633
	Sometimes	19	11.2	14	9.0	
	No	26	15.3	20	12.9	
Most feed formula in EN	Standard formula	87	51.2	74	47.7	0.822
	Specialized formula	63	37.1	62	40.0	
	Blenderized formula	20	11.8	19	12.3	
Elevate the patient head position 45° after feeding	Yes	127	74.7	115	74.2	0.441
	Sometimes	6	3.5	10	6.5	
	No	37	21.8	30	19.4	
Return the patient to the original position after feeding	Yes	86	50.6	58	37.4	0.011*
	Sometimes	19	11.2	34	21.9	
	No	65	38.2	63	40.6	
Last step in nasogastric tube feeding	Access for bowel sounds	25	14.7	24	15.5	0.808
	Auscultate tube placement & check pH	53	31.2	41	26.5	
	Flush the tube with water	46	27.1	43	27.7	
	Re-flush the tube with water	46	27.1	47	30.3	

* p < 0.05 using Pearson Chi square.

methods which increases the risk of respondent error. Thirdly; nurses were from various wards, placing them at a disadvantage in comparison with those who are in ICU and manage enteral nutrition day by day. Finally; hospitals took apart in the current study did not have standard enteral nutrition guidelines and protocols and did not organize similar continuing or in-service training programs. Nevertheless, the current study provides for the first-time worthy data on the nurses' knowledge,

Table 5
Percentages of nurses responded to 20 nutritional knowledge questions.

Knowledge item	CA	WA/DK
	n (%)	n (%)
1. Pancreatitis is an indication to start enteral feeding. (T)	124 (38.2)	201 (61.8)
2. Nasogastric can be administered by bolus injection or by intermittent or continuous infusions (T)	218 (67.1)	107 (32.9)
3. Continuous drip method doesn't require a pump. (F)	184 (56.6)	141 (43.4)
4. Intermittent drip-feeding regimen can be given by pump or gravity drip. (T)	236 (72.6)	89 (27.4)
5. Continuous drip method is the most problematic for drug-nutrient interaction. (F)	100 (30.8)	225 (69.2)
6. The closed tube system is better as compared to the opened tube system due to? (Less contamination)	173 (53.2)	152 (46.8)
7. Tube dislodgement is considered one of the complications of EN (T)	185 (56.9)	140 (43.1)
8. Blenderized tube feedings are contraindicated for patients who are immune-compromised. (T)	117 (36.0)	208 (64.0)
9. The difference between ensure and ensure plus is: (Ensure provides 250 cal and 9 g protein and ensure plus provides 350 cal and 13 g protein per serving)	91 (28.0)	234 (72.0)
10. The purpose of flushing is to check for preventing clogging of enteral tubes (T)	265 (81.5)	60 (18.5)
11. Enteral feeding tubes should be flushed with water just prior to feeding. (F)	116 (35.7)	209 (64.3)
12. Enteral tubes should be flushed with 5–20 ml of water. (T)	230 (70.8)	95 (29.2)
13. Medications can be administered with feeding (F)	107 (32.9)	218 (67.1)
14. Nasogastric route is part of short-term enteral feeding support for less than 4 weeks (T)	226 (69.5)	99 (30.5)
15. The ongoing assessment of nasogastric tube placement every: (24 h)	74 (22.8)	251 (77.2)
16. Feeds are usually commenced at (ml/h): (Low rate about 25–50 ml/h)	176 (54.2)	149 (45.8)
17. The bed position of conscious patient can be changed after: (60 min after feeding)	87 (26.8)	238 (73.2)
18. Post-pyloric feeding is associated with fewer interruptions once EN has been started. (T)	187 (57.5)	138 (42.5)
19. Post-pyloric feeding may reduce the risk of gastroesophageal reflux. (T)	208 (64.0)	117 (36.0)
20. Which of the following provides greater physiologic benefits? (Intragastric feeding)	147 (45.2)	178 (54.8)

CA: correct answer; DK: don't know; F: false; T: true.

Table 6
The relationship between nurses' knowledge score and nurses' attitudes.

Variables		Mean ± SD	p-Value
The complications of enteral feeding are less than parenteral feeding.	Agree	10.1 ± 2.6	0.000*
	Disagree	9.0 ± 2.8	
	No opinion	7.4 ± 3.3	
Enteral feeding is a safe way to feed in cases where oral feeding is contraindicated.	Agree	10.1 ± 2.6	0.000*
	Disagree	8.9 ± 3.0	
	No opinion	8.5 ± 2.8	
Enteral feeding increases the burden on nursing personnel.	Agree	9.7 ± 2.7	0.028*
	Disagree	10.1 ± 2.9	
	No opinion	9.0 ± 2.6	
It is better to avoid enteral feeding because it leads to complications such as aspiration.	Agree	10.0 ± 2.5	0.000*
	Disagree	9.9 ± 2.7	
	No opinion	8.3 ± 3.3	
I think that the nurses have a role in providing adequate nutrition.	Agree	10.1 ± 2.5	0.000*
	Disagree	8.9 ± 2.8	
	No opinion	8.3 ± 3.4	
It is important for nursing personnel to understand how to administer tube feeding for the well-being of the patient.	Agree	10.2 ± 2.5	0.000*
	Disagree	8.6 ± 2.7	
	No opinion	8.1 ± 3.1	
Tube feeding is an expensive treatment and it does not have any impacts and benefits for critically ill patients.	Agree	9.2 ± 2.7	0.002*
	Disagree	10.2 ± 2.8	
	No opinion	9.0 ± 2.8	
I am generally satisfied with the quality of enteral feeding given for hospitalized patients.	Agree	10.1 ± 2.4	0.020*
	Disagree	9.2 ± 3.1	
	No opinion	9.1 ± 3.0	
I think that it is difficult to administer tube feeding because limited instruction is provided by the Dietitian.	Agree	10.0 ± 2.6	0.009*
	Disagree	9.8 ± 2.9	
	No opinion	8.7 ± 2.7	
I think that complications of enteral feeding can be controlled by different practices or different regimens.	Agree	10.0 ± 2.7	0.022*
	Disagree	9.2 ± 2.9	
	No opinion	9.1 ± 2.8	

SD: standard deviation.

* Significant at p < 0.05 using one-way ANOVA.

practices, and attitudes.

5. Conclusion

According to the findings of the current study, it was noted that nurses' knowledge score regarding enteral nutrition was in adequate which could possibly increase the risk of mortality, complications and hospitalization. It was further demonstrated that nurses' knowledge was influenced by attitudes, and practices. It was also noticed that most

Table 7
The relationship between nurses' knowledge score and nurses' practices.

Variables		Mean ± SD	p-Value
Dealt with EN patient	Yes	10.1 ± 2.5	0.000*
	Sometimes	9.1 ± 3.2	
	No	8.4 ± 3.2	
Flush the tube with 5 cm ³ water after feeding	Yes	10.3 ± 2.5	0.000*
	Sometimes	8.4 ± 2.4	
	No	8.0 ± 3.0	
Give medication for the patient	Yes	10.2 ± 2.5	0.000*
	Sometimes	7.8 ± 2.5	
	No	8.1 ± 3.0	
Check residual volume	Yes	10.1 ± 2.4	0.000*
	Sometimes	8.4 ± 3.2	
	No	8.0 ± 3.5	
Most feed formula in EN	Standard formula	10.0 ± 2.7	0.109
	Specialized formula	9.4 ± 2.9	
	Blenderized formula	9.2 ± 2.8	
Elevate the patient head position 45° after feeding	Yes	10.2 ± 2.5	0.000*
	Sometimes	6.9 ± 3.8	
	No	8.3 ± 2.8	
Return the patient to the original position after feeding	Yes	10.1 ± 2.6	0.005*
	Sometimes	8.7 ± 2.7	
	No	9.5 ± 2.9	
Last step in nasogastric tube feeding	Access for bowel sounds	9.8 ± 2.8	0.595
	Auscultate tube placement & check pH	9.4 ± 3.0	
	Flush the tube with water	9.6 ± 2.6	
	Re-flush the tube with water	10.0 ± 2.7	

SD: standard deviation.

* Significant at p < 0.05 using one-way ANOVA.

aspects of nurses' practices were consistent with the international guidelines such as backrest elevation and flushing the tube. Applying the existing evidences in the daily practices and collaboration among the healthcare team could ameliorate enteral nutrition practices.

Study design, settings, and population

The study design is observational cross-sectional study. The study population was registered nurses working in six different hospitals in west bank region/Palestine (Princess Alia Governmental Hospital, Al-Ahli hospital, Istishari Arab Hospital, An-Najah National University Hospital, Rafidia Surgical Hospital).

Ethical consideration

The study protocol was approved by the Deanship of Scientific Research Ethical Committee at Palestine Polytechnic University

committee. Permissions and approval to conduct the study were obtained from the Palestinian Ministry of Health. All nurses in the six hospitals were invited to join the study, and they were briefed about the study design, objectives, and the type of data that would be collected, with affirmation on the optional participation. Nurses who agreed to sign the consent form were included in the data collection.

Consent for publication

Not applicable.

Availability of data and materials

The dataset used and analyzed in this study is available from corresponding Author on reasonable request.

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Declaration of competing interest

The authors declare they have no competing interests.

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