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Original Research Article

Evaluation of Ibri Hospital Nurses' Knowledge about Enteral Feeding Intolerance Definition, Causes, Symptoms and Possibility of Oral Medication Administration

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Abstract

Background: Enteral feeding intolerance (EFI) is a critical concern in critically ill patients, associated with complications like vomiting, elevated gastric residual volumes (GRV), and delayed gastric emptying. Despite its prevalence, EFI lacks a universally accepted definition and standardized management protocols, leading to inconsistent practices among healthcare providers. ***Aim***: This study aimed to evaluate nurses' knowledge at Ibri Hospital regarding EFI, including its definition, causes, symptoms, and the feasibility of oral medication administration during intolerance episodes. Evidence-based recommendations were proposed to improve enteral feeding practices. ***Methods***: A cross-sectional descriptive design was used, involving 170 nurses from inpatient departments at Ibri Hospital. Data were collected via a validated online questionnaire and analyzed using SPSS. Key knowledge areas assessed included EFI indicators, GRV thresholds, and clinical management practices. Convenience sampling was employed. ***Results***: The study revealed variability in nurses' understanding of EFI indicators and GRV thresholds. Vomiting was the most recognized EFI indicator, though only 62% identified it correctly. GRV threshold knowledge varied, with 61% selecting context-dependent measurements. Pediatric ward nurses demonstrated the highest knowledge, while operating theater staff scored the lowest. Training had minimal impact, except for improved recognition of vomiting as an indicator ($p = 0.025$). Nurses favoring early feeding initiation and timely restarting showed higher knowledge scores. ***Conclusions***: Significant knowledge gaps and inconsistencies in EFI practices were identified. Recommendations include developing evidence-based EFI protocols, regular interdisciplinary training, and promoting collaborative decision-making. Future research should validate findings and assess the impact of standardized EFI protocols on patient outcomes.

Keywords: Enteral feeding intolerance, gastric residual volume, nursing knowledge, clinical practice, feeding intolerance indicators.

CHAPTER 1: INTRODUCTION & BACKGROUND

1.1 Introduction and Background

At the beginning of this study, I went through extensive literature search to have a clear idea about the study topic (Feeding intolerance) world widely. A different electronic search engines were utilized including Google Scholar, Cochrane Library, and Ministry of Health electronic library. In addition, I went through the ICU medical nutrition therapy guidelines for directorates and referral hospitals. The search covered many materials published from 2020 to 2024 but it was limited to English language martials.

Enteral feeding is the prioritized method of administering nutrients to patients, particularly in critical care settings. Around the world, enteral feeding intolerance (EFI) is a prevalent condition mostly in critically ill patients, though it lacks a precise, universally accepted definition. EFI is commonly characterized by symptoms such as vomiting, excessive gastric residual volumes (GRV), and delayed gastric emptying due to gastroparesis or other conditions. Different pathophysiological pathways contributing to EFI may influence its relationship with clinical outcomes, highlighting the complexity of its management (Reintam Blaser *et al*., 2020).

Enteral tube feeding is a substantial form of nutritional support for patients with a functionally normal gastrointestinal tract but insufficient oral intake to meet their nutritional needs (Bischoff *et al*., 2020). Based on various studies, FI is not yet well defined but is frequently associated with elevated GRV and gastrointestinal (GI) symptoms. However, GRV has been shown to correlate poorly with delayed gastric emptying, and no consensus exists on GRV thresholds or their reliability in diagnosing FI (Jenkins *et al*., 2022).

While the American Society of Enteral and Parenteral Nutrition (ASPEN) suggests discontinuing GRV monitoring in ICU patients, the European Society of Clinical Nutrition and Metabolism (ESPEN) recommends delaying EN if GRV exceeds 500 mL/6 h and notes the necessity of monitoring GRV to manage EFI effectively (Jenkins *et al*., 2023). However, no universal GRV threshold exists, with reported values ranging from 75 to 1200 mL (Jenkins *et al*., 2023).

FI is a prevalent issue among patients receiving enteral nutrition (EN), particularly in critically ill populations. Enteral tube feeding intolerance (ETFI) was reported in nearly two-thirds (66%) of critically ill patients on EN, contributing to prolonged ICU stays and higher mortality rates. FI is also associated with deteriorated nutritional status and poor clinical outcomes in ICU patients receiving early continuous EN (Sedaghat *et al*., 2021).

FI lacks a standardized definition but is commonly diagnosed based on elevated GRV and GI symptoms. Research, however, shows no strong correlation between GRV thresholds and the prevalence of FI, emphasizing the need for a more precise definition. Proposed definitions suggest that FI involves GI symptoms and an inability to meet EN goals (Jenkins et al., 2022; Eveleens *et al*., 2020).

Monitoring GRV is a standard practice in ICUs for detecting EFI, but evidence supporting its utility is inconsistent. A UK survey found that 86% of ICUs used GRV to assess EFI, with threshold values ranging from 200 to 1000 mL and measurement intervals from 2 to 12 hours. However, only 28% of units had clear GRV monitoring protocols (Jenkins *et al*., 2023). Alternative approaches, such as gastrointestinal nursing assessments, have been shown to improve EN delivery and reduce complications, advocating for discontinuing routine GRV monitoring (Landgrave, 2024; Wiese *et al*., 2020).

EFI is linked to several factors, including GI dysfunction, intra-abdominal pressure, sedation, and vasoactive medications. Patients with burns or GI disorders are at higher risk of EFI, which is associated with poorer clinical outcomes and reduced EN delivery (Heyland *et al*., 2020; Jenkins *et al*., 2023).

Studies indicate significant gaps in nurses' knowledge of EFI and EN management. In Egypt, two-thirds of neonatal nurses lacked adequate knowledge about EN, affecting patient outcomes (Gomaa *et al*., 2022). Similarly, in South Africa, younger, less experienced private hospital nurses demonstrated better knowledge than their public hospital counterparts, underscoring the importance of effective training and clear protocols (Mooi, 2018). Enhanced nursing knowledge has been shown to improve EN initiation, reduce complications, and favorably impact critically ill patients' outcomes.

1.2 Aim of the study:

The main aim of this study is to evaluate Ibri hospital nurses' knowledge about enteral feeding intolerance definition, causes, symptoms and possibility of oral medication administration.

1.3 Objectives:

- To come out with a clear definition of feeding intolerance.
- To gain a perspective of current practice by nurses regarding enteral feeding and monitoring of GRV.
- To characterize the threshold value used for a high GRV in clinical practice.
- To describe the impact of GRV monitoring on enteral feeding provision.
- To inform future research into the clear signs of feeding intolerance.
- To provide a clear guide of the possibility of medication administration in patient with enteral feed.
- To provide recommendations for proper enteral feed to different patient's categories.

1.4 Research Question:

What are the clinical, procedural and experiential factors influencing staff nurses knowledge and management of feeding intolerance, including its relationship with GRV, medication administration, diarrhea, vomiting, workplace environment, and years of experience?

1.5 Hypothesis:

Alternative hypothesis:

1. There is significant relationship between receiving a training/course in therapeutic nutrition and staff nurse knowledge of feeding intolerance. There is significant relationship between diarrhea and vomiting and feeding intolerance.

Null hypothesis:

1. There is no significant relationship between years of experience and the staff nurse knowledge of feeding intolerance.

2. There is no significant relationship between Feeding intolerance and oral medication administration.

1.6 Justification of the study

During my short experience as a nurse in Ibri hospital I noticed that There are no clear definition for feeding intolerance that can be utilized as a guidance for practice. In practice observation, some nurses would stop the feed after aspirating 60ml, others after 100ml, some would give metoclopramide dose and resume feed after 1hr others would give GI rest of 4hrs or more!

Unfortunately, there is no clear recorded statistics of feeding intolerance all around Oman.

According to a dietitian in sultan Qapoos cancer center, many patients may go to total parenteral nutrition (TPN) as according to their nurse they don't tolerate the feed, without a clear cause!

Based on therapeutic nutrition department in Ibri hospital about 60% of patient who receive enteral feeding may encounter feeding intolerance, the percentage increases in ICU, with burn cases and mechanically ventilated patients. Moreover, during 2023 "136" enteral feeding plan were written, "23" of them were in ICU of which 17 patient "almost 75% of all ICU patients who received enteral feeding" needed a plan change due to continuous report of intolerance among them, 2 patients needed to start total parenteral nutrition. Furthermore, since the January 1st 2024 until May 29th of the same year 76 nutritional plan of enteral feeding were written and many of them needed modification due to feeding intolerance, with no clear record of their exact number.

In short, feeding intolerance is generally assessed by nurses. Different nurses' perception would result in different judgement and thus interruption of feeding plans that could result on poor outcomes as result of not meeting nutritional needs. This gives alarm on different nurses' perception of feeding intolerance and the need for generalized criteria of judgement to be applied in all hospitals.

1.7 Limitation and constraint of the study

- Difficulty to do direct assessment of the staff actual work and depending only on their answer to online questionnaire.
- Limited Omani published studies in the field of Nutrition.
- Difficulty to manage the time between shift duties and working on the study.

CHAPTER 2: METHODOLOGY

2.1 Research design:

The current study is nonexperimental mixed "qualitative and quantitative" research and will follow a cross sectional descriptive design

2.2 Characteristics of Study Area and Target Population:

The target population is All Nurses working in in-patient departments in Ibri regional hospital.

2.3 Subject/Sample:

2.3.1 Inclusion Criteria:

- Ibri hospital nurses who work in in-patient departments.

2.3.2 Exclusion Criteria:

- Ibri hospital nurses who work in out-patient departments.
- Ibri hospital employees that are not nurses.
- Nurses in other hospitals.

2.4 Sampling Method

2.4.1 Sampling Frame

The sample frame of this study is the list of nurses working in Ibri regional hospital in-patient departments and meet the study criteria.

2.4.2 Sample Size Calculation

During the year 2024 there is 454 nurses working in Ibri hospital, 27 of them are working in out-patient departments. The rest are our target group. This number was used to calculate the sample used for this intended study. Sample size was calculated using well-known formula for cross sectional study design (SurveyMonkey, 2024).

$$\text{Sample size} = \frac{\frac{z^2 \times p\,(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p\,(1-p)}{e^2 N}\right)}$$

N = population size, 527 "Nurses in Ibri hospital in-patient departments population"
e = Margin of error, 5
z = z-score, 1.65
p = sample proportion, 50%
Confidence level= 90%

The sample size of the proposed based on the above equation is 167 participants.

2.4.3 Sampling Methods

In this study convenience sampling was utilized to achieve the study aim.

2.5 Data collection tool:

- The study used a questionnaire developed and constructed by the researcher.
- The researcher disseminated the questionnaire online to the in-charges of the different departments.

- The questionnaire validity and ethical approval was taken by research committee members in ministry of health.
- A copy of the questionnaire is attached in appendix 1.

2.5.1 Scoring system

Each correct response took two scores, an incomplete one took one score, and the wrong answer or the not known response took no score (zero).

2.6 Pilot study

The aim of the pilot study is to examine the research process starting from data collection to the report writing. It was conducted on 10% (17 nurses) of the study subjects to examine the tools' clarity, feasibility, and applicability and estimate the time needed for filling the sheets. Subjects included in the pilot study were selected randomly from the study setting and included in the study sample. The pilot study results were utilized as a basis for any necessary modifications before conducting the actual study.

2.7 Data Management

2.7.1 Quality control of data and Statistical treatments

To ensure that data quality control is satisfying in this study, once data is collected, the checklist was reviewed by researcher. The collected data were analyzed by Statistical Package for the Social Sciences (SPSS) version 23. Once the data input is complete in the SPSS program, a random check of the randomly selected requests was performed. This ensure that data is entered correctly. Descriptive analysis was done to describe the characteristics of the participants.

Random check of the randomly selected requests will be performed. This will help ensure that data is entered correctly. Descriptive analysis was done to describe the characteristics of the participants. Means and standard deviations or proportions, and percentages conducted to describe participants' years of experience. Descriptive statistics (frequency tables, measures of central tendency and graph) will be used to present the proposed study data, inferential analysis (Pearson Chi-Square Test, parametric test, correlation and regression analysis) used to analyze the data. Quantitative data will be entered, coded and analyzed using univariate analysis (Pearson Chi-Square test, correlation and regression analysis) and descriptive statistics (frequency table, measures of central tendency and graphs). P value <0.05 was considered as statistically significant.

2.7.2 Ethical consideration:

The need to obtain research ethical approval is important to all research involving human participants. This approval must be obtained in all stages of the research. One way that research participants can be assured that potential risks have been considered, reduced and considered appropriate is the ethical review process (Guckian & Thampy, 2022).

Therefore, a copy of the study was submitted to the Research Service Committee in AlDhahira governorate through the concerned person in Ibri hospital through their website for comments and approval.

Inform consent was taken, before completing the questionnaire at the first page of the on-line questionnaire, no participant's name will be written, Participation is voluntary, and the participants have the right to withdraw from the study at any time. The consent form will be written in clear an easily understandable manner for all participant. Moreover, the collected information will be kept confidential and will be used for study purpose only. The participants who are willing to participate in the study will sign the consent form. A copy of the informed consent form is available at appendix2.

CHAPTER 3: PRESENTATION, INTERPRETATION & ANALYSIS OF DATA

3.1 Data analysis

Descriptive analysis was done to describe the characteristics of the participants. Means, modes and standard deviations or proportions, Descriptive statistics (frequency tables, measures of central tendency, and graphs) were used to present the study data, inferential analysis (Pearson Chi-Square Test) was used to analyze the data and to divide the client responses, Quantitative data were entered, coded and analyzed using univariate analysis inferential (Pearson Chi-Square test) and descriptive statistics (frequency table, measures of central tendency and graphs). P value <0.05 was considered as statistically significant.

Table 1: Knowledge Scores Based on Demographic and Training Characteristics

Variable	Category	N (%)	Mean ± SD	(Min-Max)	P value
Gender	Male	33(19.4%)	4.42 ± 1.25	(2-7)	0.644
	Female	137(80.6%)	4.28 ± 1.62	(1-11)	
Level of Education	Diploma	52(30.6%)	4.1 ± 1.46	(2-7)	0.286
	Bachelor (BSN)	117(68.8%)	4.39 ± 1.59	(1-11)	
	Doctorate	1(0.6%)	6 ± 0	(6-6)	
Ward/Unit	ICU	21(12.4%)	4.52 ± 0.98	(3-6)	0.204
	NICU	10(5.9%)	3.9 ± 1.37	(2-6)	
	Pediatric wards	16(9.4%)	5.31 ± 1.62	(3-8)	
	Male wards	26(15.3%)	4.38 ± 1.36	(2-7)	

Variable	Category	N (%)	Mean ± SD	(Min-Max)	P value
	Female wards	35(20.6%)	4.23 ± 1.85	(1-11)	
	Gyn/maternity wards	11(6.5%)	4.36 ± 1.8	(2-7)	
	RMU	20(11.8%)	4.05 ± 1.73	(2-7)	
	OT	9(5.3%)	3.56 ± 1.01	(2-5)	
	ED	22(12.9%)	4.14 ± 1.46	(1-7)	
Training	Yes	45(26.5%)	4.33 ± 1.48	(1-8)	0.821
	No	125(73.5%)	4.27 ± 1.75	(1-11)	

Table 1 presents the knowledge scores across various demographic and training characteristics. Gender-wise, males (19.4%) scored a mean of 4.42 ± 1.25 (range: 2–7), while females (80.6%) scored 4.28 ± 1.62 (range: 1–11), with no significant difference (p = 0.644). Regarding education levels, participants with a diploma (30.6%) had a mean score of 4.1 ± 1.46, while those with a bachelor's degree (68.8%) scored 4.39 ± 1.59, and the single doctorate holder scored 6.0, though differences were not significant (p = 0.286). Knowledge scores also varied across wards/units, with pediatric ward staff achieving the highest mean score (5.31 ± 1.62), while operating theater (OT) staff scored the lowest (3.56 ± 1.01), though differences across units were not statistically significant (p = 0.204). Lastly, training experience showed minimal impact, as trained participants (26.5%) had a mean score of 4.33 ± 1.48 compared to 4.27 ± 1.75 among untrained participants (73.5%), with no significant difference (p = 0.821). Overall, no variable showed a statistically significant association with knowledge scores. Figure 1 illustrates a clear participants distribution based on gender, level of education, and training on feeding.

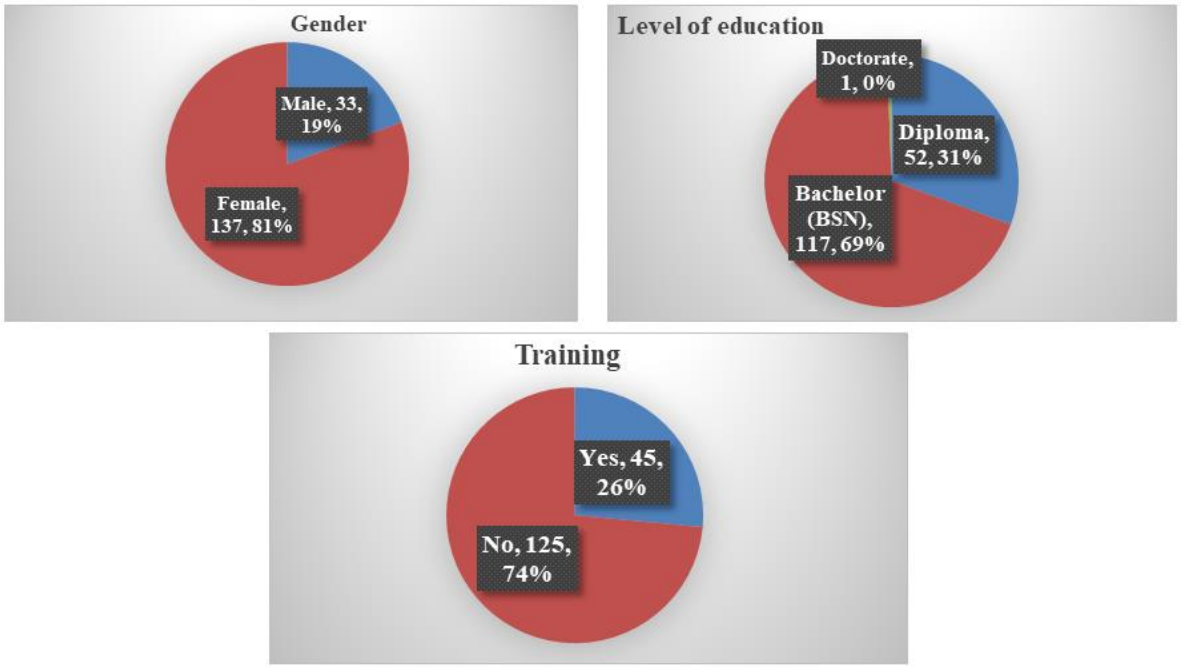

Figure 1

Table 2: Knowledge of EFI Indicators and Feeding Practices

Variable	Category	N (%)	Mean ± SD	(Min-Max)	P value
Indicators of EFI	Gastric residual volume (GRV)	124(72.9%)	4.25 ± 1.42	(1-8)	0.396
	Vomiting	106(62.4%)	4.53 ± 1.81	(1-11)	0.222
	Abdominal Distention	81(47.6%)	4.31 ± 1.73	(1-11)	0.980
	Diarrhea	58(34.1%)	4.38 ± 1.69	(1-11)	0.480
	Bowel Sounds	53(31.2%)	4.6 ± 1.73	(1-11)	0.078
Amount of GRV for EFI	Less than 60 mL	11(6.5%)	2.91 ± 0.83	(2-4)	0.001
	Less than 100 mL	23(13.5%)	3.17 ± 1.11	(2-5)	
	Less than 150 mL	15(8.8%)	3.6 ± 1.35	(2-6)	
	Less than 200 mL	17(10%)	3.24 ± 1.2	(1-5)	
	Depends on last 6 hours	104(61.2%)	4.99 ± 1.38	(3-11)	
	Yes	47(27.6%)	3.46 ± 1.41	(2-7)	0.001

Variable	Category	N (%)	Mean ± SD	(Min-Max)	P value
Is diarrhea a reason to stop feeding?	No	24(14.1%)	3.85 ± 1.23	(1-7)	
	Depends on history	99(58.2%)	4.74 ± 1.58	(1-11)	
Is vomiting a reason to stop feeding?	Yes	121(71.2%)	3 ± 1.73	(2-5)	0.014
	No	3(1.8%)	4.52 ± 1.63	(1-11)	
	Depends on history	46(27.1%)	3.85 ± 1.17	(1-6)	

The analysis of knowledge regarding Enteral Feeding Intolerance (EFI) indicators and related feeding practices reveals varying levels of understanding among participants. The most recognized indicator was Gastric Residual Volume (GRV) (72.9%, mean score 4.25 ± 1.42), followed by Vomiting (62.4%, mean score 4.53 ± 1.81) and Abdominal Distention (47.6%, mean score 4.31 ± 1.73). None of the EFI indicators were significantly associated with knowledge scores ($p > 0.05$). When analyzing the amount of GRV, participants who selected "Depends on the last 6 hours" scored significantly higher (mean score 4.99 ± 1.38, $p = 0.001$) compared to those selecting specific thresholds (e.g., <60 mL, <100 mL). Regarding diarrhea as a reason to stop feeding, scores were significantly higher among participants who answered, "Depends on history" (mean score 4.74 ± 1.58, $p = 0.001$), suggesting a nuanced understanding of feeding practices. Similarly, for vomiting, those who answered "Depends on history" scored higher (mean score 3.85 ± 1.17, $p = 0.014$) than participants who unequivocally considered it a reason to stop feeding. Figure 2 shows the participants response to the amount of GRV considered as feeding intolerance, while figure 3 shows the participants response to the indicators of feeding intolerance.

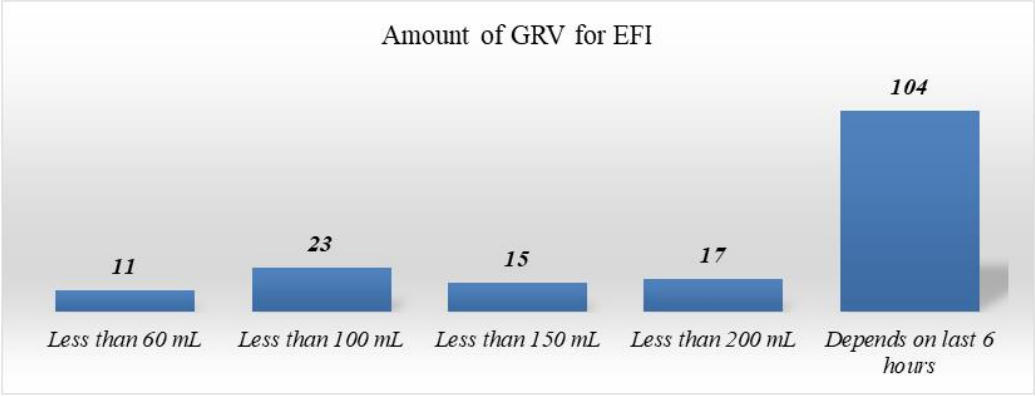

Figure 2

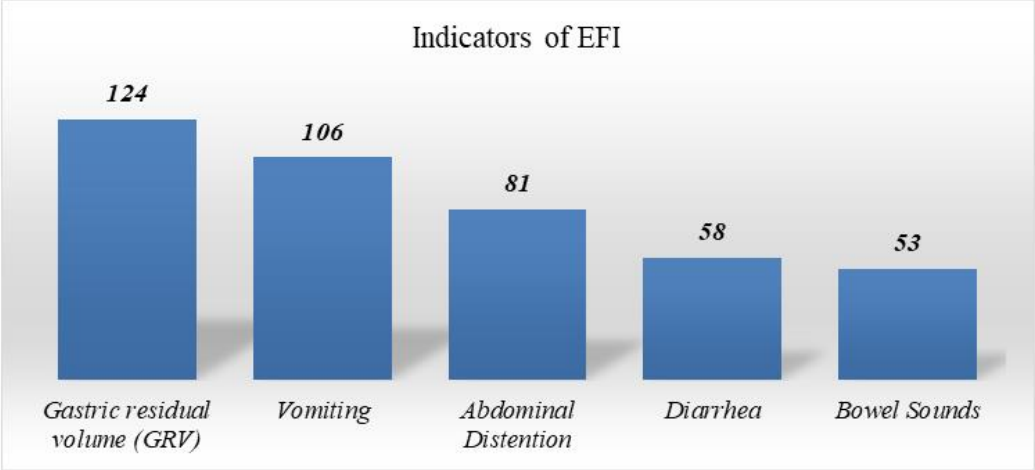

Figure 3

Table 3: Knowledge of EFI Based on Patient Age, Early Feeding, and Restarting Feeding Trials

Variable	Category	N (%)	Mean ± SD	(Min-Max)	P value
Effect of Patient Age on EFI	No	22(12.9%)	3.55 ± 1.37	(1-7)	0.001
	Children (<3 years)	18(10.6%)	3.5 ± 1.1	(2-6)	
	Elderly (>60 years)	26(15.3%)	3.12 ± 0.82	(2-5)	

Variable	Category	N (%)	Mean ± SD	(Min-Max)	P value
	Both (<3 years and >60 years)	104(61.2%)	4.91 ± 1.5	(2-11)	
Preferred Time for Early Feeding Initiation	12 hours	104(61.2%)	4.78 ± 1.52	(2-11)	0.001
	24 hours	58(34.1%)	3.57 ± 1.35	(1-7)	
	72 hours	5(2.9%)	4 ± 0.71	(3-5)	
	48 hours	3(1.8%)	3 ± 1	(2-4)	
Restarting Feeding Trials After Intolerance	After 12 hours	49(28.8%)	5.63 ± 1.65	(2-11)	0.001
	After 24 hours	69(40.6%)	3.64 ± 1.15	(1-6)	
	After 72 hours	26(15.3%)	3.77 ± 1.03	(2-6)	
	After 48 hours	26(15.3%)	4.15 ± 1.16	(2-6)	

The analysis highlights significant differences in knowledge regarding Enteral Feeding Intolerance (EFI) based on patient age, preferred early feeding time, and restarting feeding trials after intolerance. Regarding the effect of patient age on EFI, participants who recognized that both children under 3 years and elderly patients over 60 years are prone to EFI scored significantly higher (mean 4.91 ± 1.5, p = 0.001) compared to those considering only children (mean 3.5 ± 1.1) or elderly (mean 3.12 ± 0.82). For early feeding initiation, participants who preferred initiation within 12 hours scored the highest (mean 4.78 ± 1.52, p = 0.001), while those preferring 48 hours scored the lowest (mean 3 ± 1). Regarding restarting feeding trials after intolerance, those favoring restarting after 12 hours scored the highest (mean 5.63 ± 1.65, p = 0.001), while those preferring 24 hours had lower scores (mean 3.64 ± 1.15). These findings suggest that higher scores are associated with contextually appropriate responses, such as early feeding and timely restarting of feeding trials, emphasizing the importance of nuanced clinical decision-making in managing EFI. Training efforts should focus on enhancing knowledge in these areas. Figures 4, 5, 6 shows the effect of patient age on EFI, Preferred time for enteral feed initiation, and restarting feeding trials after intolerance respectively from the study participants perspectives respectively.

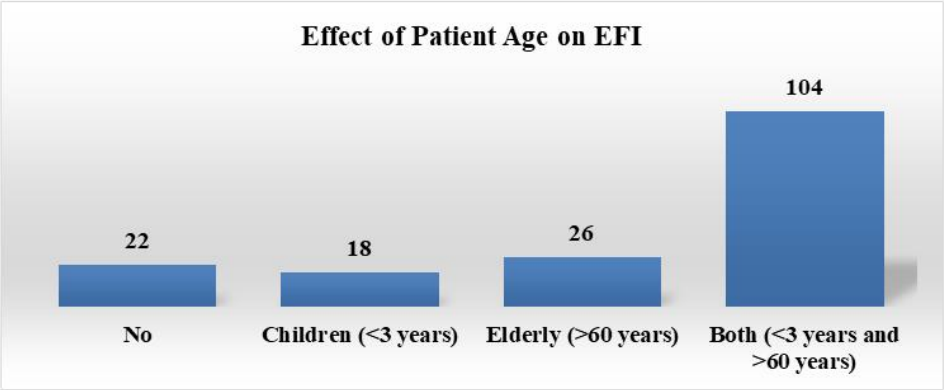

Figure 4

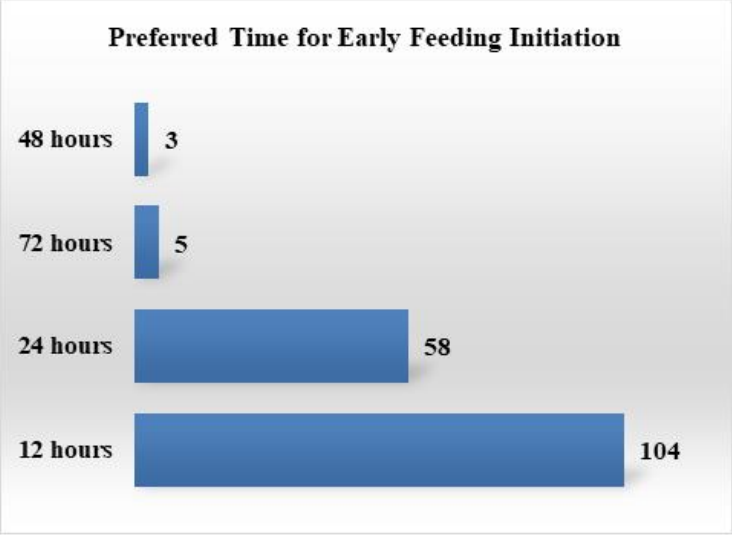

Figure 5

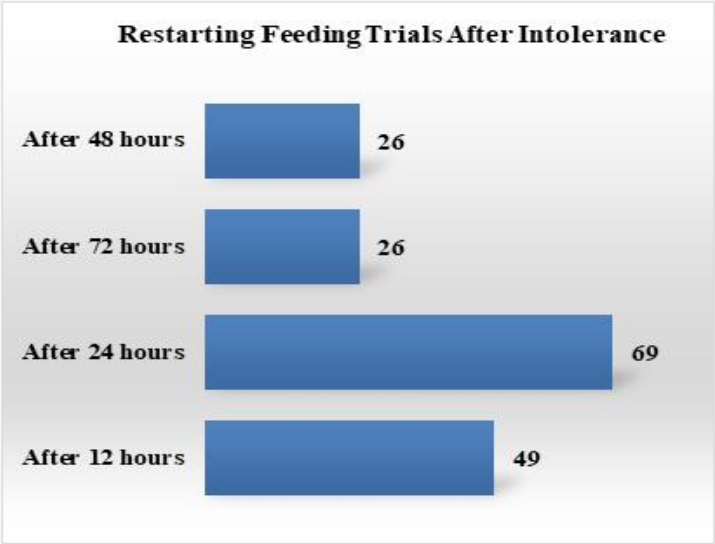

Figure 6

Table 4: Association between Training on Enteral Feeding and Recognition of Feeding Intolerance Indicators

Indicator	Chi-Square	df	P value
Gastric Residual Volume (GRV)	**3.563**	**1**	**0.059**
Bowel Sounds	0.547	1	0.460
Abdominal Distention	2.518	1	0.113
Vomiting	0.485	1	0.486
Diarrhea	0.017	1	0.897

The association between training on enteral feeding and the recognition of feeding intolerance indicators reveals varying levels of significance. The chi-square test for gastric residual volume (GRV) shows a p-value of 0.059, which is close to the threshold for significance (0.05), suggesting a potential association that warrants further investigation. However, the other indicators—bowel sounds (p=0.460), abdominal distention (p=0.113), vomiting (p=0.486), and diarrhea (p=0.897)—do not show statistically significant associations with training. These results indicate that while training might have a marginal impact on recognizing GRV as an indicator, it does not significantly influence the recognition of other feeding intolerance indicators, highlighting a possible gap in training content or effectiveness.

Table 5: Summary of Pearson Chi-Square Tests with Training variable

Variables	Chi-Square Value	df	P value
GRV indicator for feeding intolerance	4.694	4	0.320
Diarrhea as an indicator to stop feeding	5.527	2	0.063
Vomiting as an indicator to stop feeding	7.371	2	0.025
Feeding intolerance as an indicator to stop oral medication	0.002	1	0.962
Age effect on likelihood of feeding intolerance	2.296	3	0.513
Preferred time to initiate early feeding	4.358	3	0.225
Time to start enteral feeding postoperatively	2.714	3	0.438
Time to restart feeding trial after intolerance	1.498	3	0.683

The summary of Pearson Chi-Square tests highlights the association between training and various aspects of enteral feeding practices and perceptions. Among the variables examined, only vomiting as an indicator to stop feeding shows a statistically significant association with training (p=0.025), suggesting that training has a meaningful impact on recognizing vomiting as a critical factor in feeding intolerance management. Other variables, including GRV as an indicator (p=0.320), diarrhea as a reason to stop feeding (p=0.063), and age-related effects on feeding intolerance (p=0.513), did not reach statistical significance. Similarly, practices such as the preferred time for early feeding initiation (p=0.225), timing for postoperative feeding (p=0.438), and restarting feeding trials after intolerance (p=0.683) showed no significant association with training. These findings suggest that while training influences specific aspects like recognizing vomiting as an indicator, its broader impact on other feeding-related decisions and perceptions may be limited.

CHAPTER 4: DISCUSSION

4.1 Interpretation of Key Findings

This study revealed variability in nurses' knowledge regarding enteral feeding intolerance (EFI) at Ibri Hospital, with significant differences observed in the understanding of indicators such as gastric residual volume (GRV), vomiting, and diarrhea. Training on enteral feeding showed limited impact on knowledge, except for recognizing vomiting as a critical indicator ($p = 0.025$). Nurses in pediatric wards had the highest knowledge scores, whereas operating theater staff scored the lowest. This disparity highlights the influence of working environments and patient populations on EFI knowledge.

Similar challenges in EFI management have been reported in other healthcare settings. Barriers such as inconsistent definitions of EFI and the lack of standardized protocols were noted in a global survey by Lambert *et al*., (2021), emphasizing that such gaps are not unique to Ibri Hospital. Studies further suggest that variability in EFI practices can lead to interruptions in nutritional plans, compromising patient recovery (Mehta *et al*., 2020).

4.2 Comparison with Existing Literature

The study findings align with global concerns regarding the lack of consensus on EFI definitions and GRV thresholds. For example, ESPEN guidelines recommend GRV monitoring only when levels exceed 500 mL over six hours (van Zanten *et al*., 2019). However, GRV monitoring's clinical utility has been questioned, with evidence suggesting that focusing on GRV alone may lead to unnecessary feeding interruptions (McClave *et al*., 2021). This inconsistency is reflected in Ibri Hospital, where GRV thresholds varied significantly among nurses.

Moreover, current study emphasized early feeding initiation as a best practice, with nurses favoring feeding within 12 hours achieving higher knowledge scores. This supports research by Al-Tarrah *et al*., (2020), which found that early enteral nutrition reduces complications and hospital length of stay.

4.3 Implications for Practice

The variability in nurses' knowledge and practices has profound implications for patient care. Incorrect EFI management may result in malnutrition, prolonged hospitalizations, and adverse outcomes, particularly for critically ill patients. Recent research by Reintam-Blaser *et al*., (2021) highlighted the need for a comprehensive approach to EFI management, integrating gastrointestinal symptom assessments alongside GRV measurements.

Additionally, the limited impact of training on EFI knowledge suggests a need to reevaluate the content and delivery of training programs. Patel *et al*., (2022) advocate for multidisciplinary training initiatives that include case-based learning and simulation exercises to enhance practical knowledge.

CHAPTER 5: CONCLUSION

This study evaluated Ibri Hospital nurses' knowledge regarding enteral feeding intolerance (EFI), including its definition, causes, symptoms, and management practices, with the goal of improving clinical practices and patient outcomes. The findings revealed notable variations in nurses' understanding of EFI indicators, such as GRV, vomiting, and diarrhea, and in their application of feeding protocols. The results also highlighted the limited impact of formal training on nurses' knowledge, suggesting a gap in the effectiveness or scope of current educational programs. The study's significance lies in its potential to enhance nursing practices by identifying critical knowledge gaps and inconsistencies. Addressing these gaps is essential, as evidence shows that inadequate recognition and management of EFI can lead to suboptimal nutritional support, prolonged hospital stays, and increased complications among patients, particularly those in critical care settings. By emphasizing the need for standardized guidelines, evidence-based training programs, and interdisciplinary collaboration, this research provides actionable recommendations to improve EFI management at Ibri Hospital and potentially across other healthcare institutions in Oman. Future studies should aim to validate these findings through observational data and explore the long-term impact of standardized protocols on patient outcomes. Ultimately, this research underscores the pivotal role of nurses in ensuring the effective administration of enteral feeding and highlights the necessity for continued professional development to optimize care for patients requiring nutritional support.

CHAPTER 6: RECOMMENDATIONS

1st to stakeholders:

Based on the findings, several recommendations can be made:

1. Standardized Protocols: Develop clear, evidence-based guidelines for EFI assessment and management, including GRV thresholds and feeding resumption timelines.
2. Enhanced Training Programs: Implement regular, interactive training sessions tailored to address gaps in EFI knowledge and practical skills.
3. Multidisciplinary Collaboration: Foster collaboration between nurses, dietitians, and physicians to create unified feeding plans, as suggested by Mooi (2018).
4. Monitoring and Feedback: Establish mechanisms to monitor adherence to protocols and provide feedback to staff, promoting continuous improvement in practice.
5. Limitations and Future Research This study's reliance on self-reported data may introduce response bias, as actual practices were not

observed. Future research should include observational studies and evaluate the impact of implemented protocols on patient outcomes. Additionally, exploring nurses' perceptions of EFI training could provide insights into improving educational interventions.

2nd to Nurses based on the collected information in this study:

1. Stay up to date regarding latest enteral feeding intolerance information
2. Consider the holistic patient condition before judging that he is having intolerance Large GRV might be a sign of delayed gastric emptying therefore the feed amount in the last 6 hours should be kept on consideration.
3. GRV monitoring's clinical utility has been questioned, with evidence suggesting that focusing on GRV alone may lead to unnecessary feeding interruptions therefore never consider it as a single cause to stop the feed.
4. Vomiting is mostly a sign of feeding intolerance while diarrhea might be pathologic and not related to the feed.
5. Medication should be administered regardless the state of intolerance unless it was suspected that the patient was not tolerating that medication. Keep in mind that the medication given through the tube can be crushed or melted or liquified, and if not ask the prescriber to write alternative either method or medication.

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Appendix 1 " Nurses knowledge on enteral feeding intolerance questionnaire"

Gender: **Level of education:**

Ward/unit:

Years of experience in the nursing field:

Have you ever had a training program or course about enteral feeding? Yes/No

Among the following what do you use as criteria to assess feeding intolerance:

GRV
Abdominal distention
Bowel sounds
Vomiting
Diarrhea

Based on your observation and study answer the following:

1. Which amount of GRV is considered an indicator for feeding intolerance

Less than 60
More than 100
More than 150
More than 200
Depends on the amount taken in the last 6hrs

2. Is diarrhea considered as indicator of feeding intolerance and thus to stop the feed? Yes/No

3. Is vomiting considered as indicator of feeding intolerance and thus to stop the feed? Yes/No

4. Is feeding intolerance considered as an indicator to stop oral medication administration? Yes/ No

5. Does the age of the patient effect the potential for them to encounter feeding intolerance?

A. Yes children less than 3years old are more prone to feeding intolerance.

B. Yes, elderlies older than 60years are more prone to feeding intolerance.
C. Yes both children older than 3 and elderlies older than 60 years are prone to feeding intolerance.
D. No

6. Early feeding is preferable so it is important to initiate it in the first ----- hours of admission:
A.12hrs B. 24hrs C. 48hrs D. 72hrs

7. We start enteral feeding post operatively after?
A.12hrs B. 24hrs C. 48hrs D. 72hrs

8. When to restart the feeding trial when patient is not tolerating the feed?
A. After 4hrs B. After 6hrs C. After 12hrs D. After 24hrs

Appendix 2"Participant consent form"

Study title: Evaluation of Ibri hospital nurses' knowledge about enteral feeding intolerance definition, causes, symptoms and possibility of oral medication administration.

The main aim of the study: is to evaluate Ibri hospital nurses' knowledge about enteral feeding intolerance definition, causes, symptoms and possibility of oral medication administration.
I have read and understood the details of this study and I have had the opportunity to ask questions about my participation. I understand that I am under no obligation to take part in this study and I have the right to withdraw from this study at any stage without giving any reason.
I agree to participate in this study: please ( ) as appropriate, Yes/No
Name of participant: _____ Age: _____ gender: Male/ Female
Signature of participant: _____
Signature of researcher: _____
Date: _____