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## RESEARCH ARTICLE

# Intensive care nurses' knowledge of enteral nutrition at public hospitals in Sana'a, Yemen: a cross-sectional survey [version 1; peer review: 1 approved with reservations, 1 not approved]

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## Abstract

**Background:** Nurses have a pivotal role in initiating and managing enteral nutrition (EN) and monitoring any potential complications. Yet, it is unclear whether Yemeni nurses have adequate knowledge to deliver and manage enteral nutrition safely. Therefore, the aim of this study was to assess the level of ICU nurses' knowledge regarding the management of EN.


**Methods:** A descriptive cross-sectional study was conducted from February 2019 to March 2019. A probability sampling method was used to recruit 174 nurses from four public hospitals in the capital city of Yemen. A self-administered 17-item questionnaire related to ICU nurses' knowledge regarding EN intervention was used to collect the data.




**Results:** Out of the 174 respondents, 60.9% were females, 48.9% were aged between 20 and 25 years and 66.1% had a 3-year nursing diploma. Most respondents (79.3%) had one to five years of working experience as nurses, while almost two-thirds (70.7%) had one to five years of working experience as an ICU nurse. Above half (59.2%) of the respondents had never attended training courses on EN management and 65.5% specified that the college or institute of nursing was the source for their knowledge about EN management. Only 10.9% of the respondents had an adequate level of knowledge, while (43.1%) of them had a moderate level of knowledge and 46.0% of them had an inadequate level of knowledge regarding the EN management. Significant associations between the level of ICU nurses' knowledge of EN management and their level of education and the sources of knowledge were detected.

**Conclusions:** The significant gap in ICU nurses' knowledge regarding

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EN management identified implies the need to upgrade and refresh of the ICU nurses' knowledge by implementing a regular training program concerning EN management.

### Keywords

Enteral nutrition, tube feeding, nurses' knowledge, intensive care units, public hospitals, Yemen



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## Introduction

Critically ill patients need regular enteral nutrition (EN) as an essential intervention to fulfil the body's dietary and physiological requirement<sup>1</sup>. EN is the recommended method of nutritional support for ICU ill patients who need extra nutritional calories because of the increased metabolic rate<sup>2</sup>. It is considered as a medical therapy in law; hence, it should not be initiated only after ethical considerations have been made.

Previously, delivering of EN to critically ill patients was considered as a type of supportive care and not a therapeutic intervention<sup>3</sup>. Based on its benefits, it is more than a supportive therapy. It has been found that EN protects critically ill patients from malnutrition and subsequently improves body immunity and healing of tissues, which decreases their physiological stress effect, peptic ulcer, rates of infection<sup>4,5</sup>, the inflammatory response and maintains the function and integrity of the bowel<sup>3,6</sup>. Although maintaining balanced feeding via EN improves patients' health-related-outcomes, overfeeding leads to an increase in the mortality rate and must be avoided<sup>7</sup>.

Malnutrition among ICU ill patients is a universal public health concern, with a prevalence rate ranging from 40 to 60%<sup>8</sup>. According to previous studies, almost 70% of ICU patients acquired malnutrition during hospitalization<sup>9</sup>. To overcome this serious problem, EN should be initiated as early as possible for critically ill patients to avoid any risk of morbidity and mortality, which usually increases due to long patient hunger<sup>10</sup>. Previous studies and nutritional guideline have recommended that EN should be started within 24 to 48 hours of patients' admission to the ICUs or after the stability of the hemodynamic state, specifically after cardiac resuscitation<sup>11</sup>. In other words, once critically ill patients are admitted to ICUs, delivering appropriate nutrition becomes imperative<sup>12</sup>.

Despite the benefits of EN to critically ill patients, this process is usually associated with many complications, particularly if performed without an adequate level of knowledge<sup>13,14</sup>. Inappropriate delivering and poor management of EN can result into several complications, such as tube blockage or mal-positioning, nausea, vomiting, pulmonary aspiration, overfeeding, diarrhoea, treatment-related complications and delivery-site related complications like infection and agitation<sup>15</sup>. ICU nurses play a significant role in preventing such complications because they are responsible for identifying patients' nutritional risk, the calories needed, initiating and managing EN and monitoring any potential complications<sup>16,17</sup>. Accordingly, they must be knowledgeable enough to administer EN to critically ill patients safely<sup>14,16</sup>. Therefore, the aim of the present study was to explore Yemeni ICU nurses' knowledge regarding management of EN. Specifically, our study aimed to answer the following two research questions:

1. What is the level of Yemeni ICU nurses' knowledge regarding EN management?
2. Are there differences in the ICU nurses' knowledge level regarding EN management based on their socio-demographic characteristics?

## Methods

### Design

A descriptive cross-sectional study design was used to assess the knowledge level of ICU nurses regarding EN management.

### Setting

The study was conducted from February to March 2019 in ICUs at four public hospitals in Sana'a, the capital city of Yemen. The four public hospitals are Al-Thawra Modern General Hospital, Al-Kuwait University Hospital, Al-Sabeen Maternity and Child Hospital, and the Republican Teaching Hospital Authority. These hospitals were selected as they are the referral hospitals for most people and the service fees are low.

### Sample size determination

According to Al-Hawaly, Ibrahim, and Qalawa results, 71.1% of the respondents had a satisfactory total level of knowledge about EN<sup>18</sup>. Because our study was a cross-sectional, the following equation was used to calculate sample size:  $N = 4pq/d^2$ , where; N: required sample size, p: expected proportion of sample (from previous studies),  $q = 100 - p$ , and  $d =$  wanted precision (10% was taken in this study). Accordingly, a sample of 163 nurses was calculated. Assuming attrition of 10% =  $16 + 163 = 179$  nurses was required.

### Sample and sampling method

Stratified sampling was utilized to select the participants from the above-mentioned public hospitals. A list of the ICU nurses' name was obtained from each hospital. The required sample was drawn randomly from each list using a systematic random technique. All ICU nurses who had at least 6 months working experience, including both males and females with different educational qualifications, who were involved directly in ICU patients care, full-time employees and had agreed to participate were eligible to take part in this study. Nurses who included in the pilot study and those who were unwilling to participate were excluded. Based on these criteria, the eligible participants were approached by the researchers at their workplace. Out of 384 ICU nurses, 174 nurses were included in this study.

### Study instrument

Based on a comprehensive review of the previous related studies, a self-administered questionnaire was developed by the researchers. The questionnaire consists of 17 questions with four possible options to be answered. The final questionnaire (see *Extended data*<sup>19</sup> for a blank copy) is divided into two sections as follow:

The first section is related to the socio-demographic characteristics of the participants: age, sex, level of education, working experience as a nurse, working experience as ICU nurse, training courses on EN and sources of knowledge about EN.

The second section is related to knowledge of ICU nurses regarding EN management and is divided into three subsections:

1. Knowledge of ICU nurses regarding before EN administration, which includes eight questions with a total of 32 responses.

2. Knowledge of ICU nurses regarding during EN administration, which involves four questions with a total of 16 responses.
3. Knowledge of the ICU nurses regarding after EN administration, which involves five questions with a total of 20 responses.

### Scoring system

The 17 questions related to knowledge were assessed with “Yes” and “No” options. After correction of some reverse statements, a score of 1 was given for each correct response, while a score of 0 was given for each “incorrect” response. The maximum score for all correct answers was 68. Correct answers were calculated to obtain total scores for all questions of the three subsections. A score of 50% or less was considered inadequate, 51–75% moderate, while 76% and above was considered as adequate<sup>20</sup>.

### Validity and reliability

Three experts in the EN from hospitals and Al-Razi University were invited to participate in examining the content validity for the instrument used in this study. Their comments concerning the tool accuracy, relevance, consistency, comprehensiveness and applicability for implementation were taken in consideration. A pilot study was conducted on 40 ICU nurses. Cronbach’s alpha test was performed to examine the reliability of the questionnaire items. The result of the alpha was 0.78, which is acceptable.

### Data collection

A self-administered questionnaire was distributed during the period of February to March 2019. The ICU nurses in the selected hospitals were invited to fill the questionnaire. Out of 179 questionnaires distributed, 174 were completed correctly and included in the final analysis.

### Data analysis

The participants’ responses were entered, cleaned, checked and explored using statistical software (IBMSPSS), version 22.0. The analyzed data was described using the mean values and standard deviations for continuous variables as well as the frequency and percentages for the categorical variables. A multinomial logistic regression and Chi-square tests were conducted to find out the associations between the ICU nurses’ knowledge and the selected socio-demographic variables. A *p*-value of  $\leq 0.05$  was reported as statistically significant.

### Ethical consideration

Ethical clearance from the Ethics Committee of Al-Razi University was obtained for the current study. Then, an official written permission was also obtained from the managers of the selected hospitals prior to conducting the study. A written consent from all involved nurses was obtained prior to conducting the study.

## Results

### Participants’ socio-demographic characteristics

Almost half of the participants’ age (48.9%) ranged from 20 to 25 years with a mean  $\pm$ SD of 26.94 $\pm$ 4.31. Most of them (60.9%)

were females and had a 3-year nursing diploma (66.1%). Regarding their previous experience, 79.3% of the participants had 1 to 5 years of working experience as nurses, while 70.7% of them had working experience as ICU nurses for the same duration. More than half of the nurses (59.20%) had never attended training courses on EN, whereas 61.5% of them specified that colleges or institutes of nursing were a source for their knowledge about EN. Further details of socio-demographic characteristics of the participants are presented in [Table 1](#). De-identified socio-demographic characteristics, in addition to individual-level responses to the questionnaire, are available as *Underlying data*<sup>21</sup>.

### ICU nurses’ knowledge regarding EN management

The results showed that only 16.1% of the participants had an adequate level of knowledge, while 44.80% of them had a

**Table 1. Participants’ socio-demographic characteristics (n=174).**

Socio-demographic characteristics	Total n (%)
<b>Age (yrs)</b>	
20–25 years	85 (48.9)
26–30 years	60 (34.5)
31–35 years	20 (11.5)
$\geq 36$ years	09 (05.2)
<b>Sex</b>	
Male	68 (39.1)
Female	106 (60.9)
<b>Level of education</b>	
Diploma	115 (66.1)
Bachelor	55 (31.6)
Master	4 (2.3)
<b>Working experience as a nurse (yrs)</b>	
1–5	138 (79.3)
6–10	25 (14.4)
>10	11 (6.3)
<b>Working experience in ICU (yrs)</b>	
1–5	123 (70.7)
6–10	32 (18.4)
>10	19 (10.9)
<b>Training courses on enteral nutrition</b>	
Yes	71 (40.8)
No	103 (59.2)
<b>Sources of knowledge about enteral nutrition</b>	
College or Institute of Nursing	114 (65.5)
Consulting colleagues	23 (13.2)
In-service training courses	24 (13.8)
Others	13 (07.5)

moderate level of knowledge and 39.10% reported an inadequate level of knowledge about pre-administration of EN. Concerning the level of the participants' knowledge on administration of EN, the results showed that the majority (49.40%) of them had an inadequate level of knowledge regarding administration of EN. However, 5.80% of the participants had an adequate level and 44.80% of them reported a moderate level of knowledge on administration of EN. Regarding the level of knowledge of EN following administration, the results revealed that most (47.70%) of the ICU nurses had an inadequate level of knowledge, and 9.20% had an adequate level, while 43% of them had a moderate level of knowledge about management following administration of EN. The detailed results are demonstrated in [Figure 1](#).

#### Overall level of the ICU nurses' knowledge regarding EN management

Concerning the overall level of ICU nurses' knowledge on the different items of EN management, the results of the current study showed that the most (46.0%) of the participants had an overall inadequate level of knowledge and only (10.9%) had an overall adequate level of knowledge, while (43.1%) had an overall moderate level of knowledge regarding the EN management. The results are illustrated in [Figure 2](#).

#### Association between the ICU nurses' characteristics and their knowledge level of EN

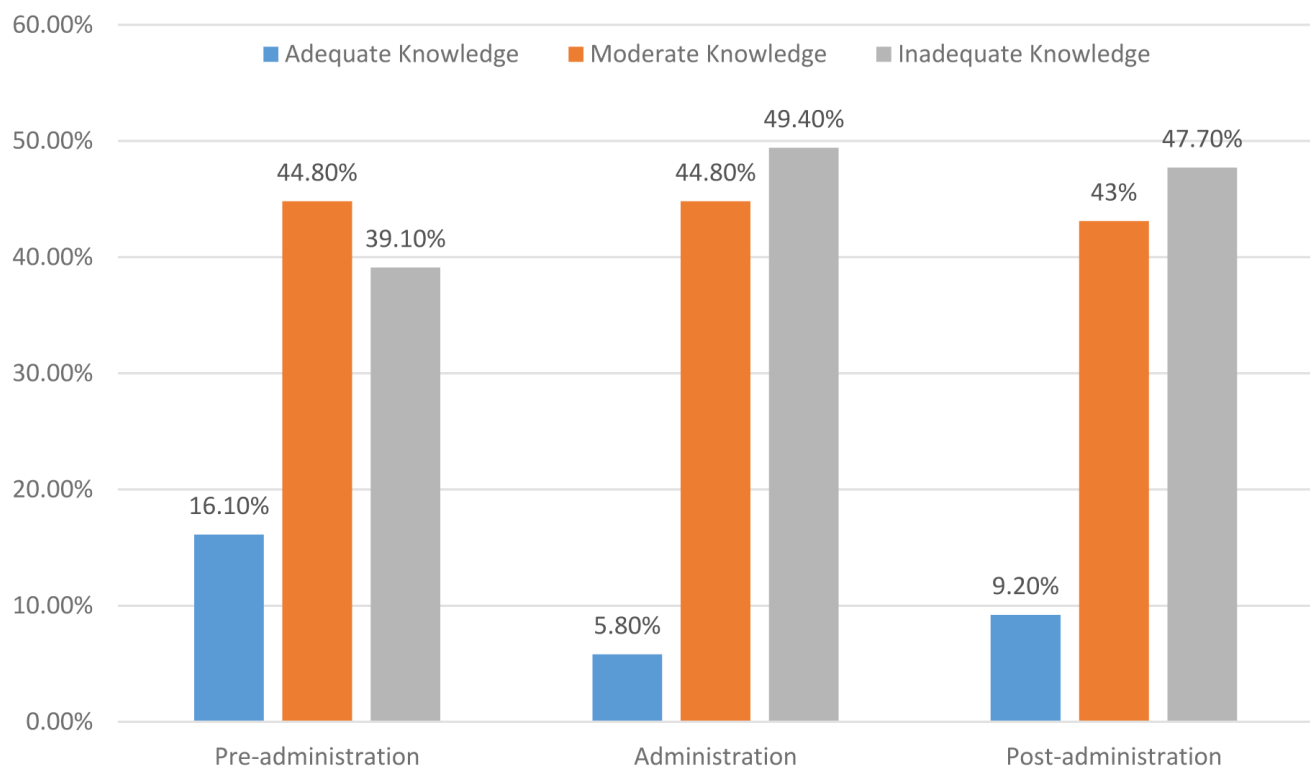
The current results indicated that there was a significant association between the level of education and sources of knowledge

about EN and the overall level of participants' knowledge of EN management ( $P=0.011$  and  $P=0.030$ , respectively). However, there were no significant associations between the participants' age, sex, experience as nurses, experience as ICU nurses and training courses and the overall level of knowledge regarding EN management ( $P= 0.276, 0.626, 0.425, 0.204$  and  $0.714$ , respectively). The detailed results of the association are presented in [Table 2](#).

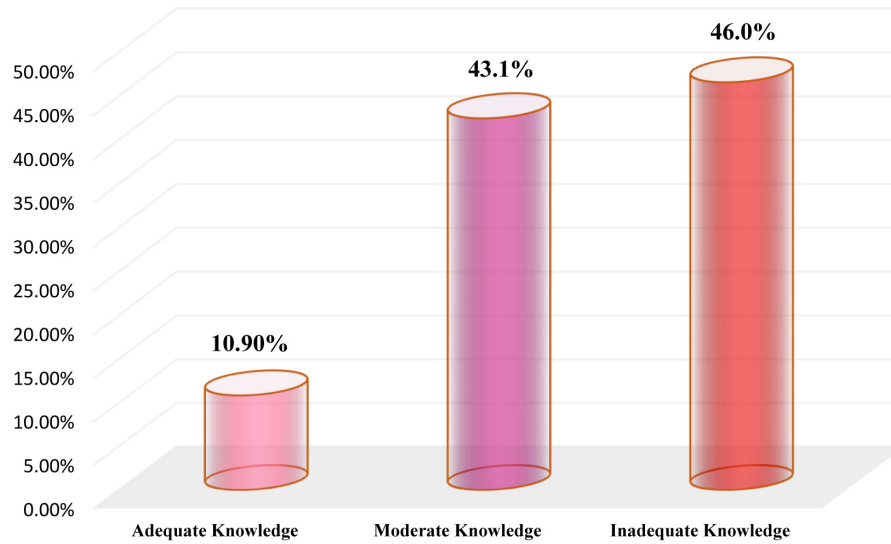
#### Discussion

The results of the current study revealed that the age of the majority of the ICU nurses' was 20 years old and above. This result indicate that most participants were fresh graduates who were assigned together to work in ICUs. This finding is consistent with the result of a previous study<sup>16</sup> which reported that over half of participants' age ranged between 26 and 35 years old. However, our result is inconsistent with the result of another study<sup>22</sup> which revealed that the majority of nurses' age were 35 years old and above. Furthermore, the results showed that the majority (60.9%) of the ICU nurses were female. The high proportion of female nurses could be related to the fact that the profession of nursing remains a female-dominant profession. This finding is similar to a previous study<sup>16</sup> that showed the majority (75%) of the participants were female nurses in the context of Egypt.

The current study revealed that more than half of the ICU nurses had a three-year nursing diploma and five years or less of work experience, either as general nurses or as ICU nurses.



**Figure 1.** Intensive care nurses' knowledge regarding EN management.



**Figure 2.** Overall level of the ICU nurses' knowledge regarding EN management.

**Table 2.** Association between the ICU nurses' characteristics and their knowledge level of EN.

Socio-demographic characteristics	Knowledge level			
	Adequate	Moderate	Inadequate	P-value
Age (years)				
20–25 years	7(8.3)	37 (43.5)	41(48.2)	0.276
26–30 years	6(10.0)	24(40.0)	30(50.0)	
31–35 years	5(25.0)	8(40.0)	7(35.0)	
≥36 years	1(11.1)	6 (66.1)	2(22.2)	
Sex				
Male	6(8.8)	32(47.1)	30(44.1)	0.626
Female	13(12.3)	43(40.6)	50(47.2)	
Level of education				
Diploma	8(7.0)	57(49.6)	50(43.5)	0.011*
Bachelor	9(16.4)	17(30.9)	29(52.7)	
Master	2(50.0)	1(25.0)	1(25.0)	
Working experience as a nurse (years)				
1–5	12(8.7)	59(42.8)	67(48.6)	0.204
6–10	6 (24.0)	10(40.0)	9(36.0)	
>10	1(9.1)	6(54.5)	4(36.4)	
Working experience in ICU (years)				
1–5	12 (9.8)	52(42.3)	59(48.0)	0.425
6–10	6(18.8)	15(46.9)	11(34.4)	
>10	1(5.3)	8(42.1)	10(52.6)	
Training courses on enteral nutrition				
Yes	8(11.3)	28(39.4)	35(49.3)	0.714
No	11(10.7)	47(45.6)	45(43.7)	
Sources of knowledge about enteral nutrition				
College or Institute of Nursing	11(9.6)	56(49.1)	47(41.2)	0.030*
Consulting colleagues	6(26.1)	8(34.8)	9(39.1)	
In-service training courses	2(8.3)	8(33.3)	14(58.3)	
Others	0(0.0)	3(23.1)	10(76.7)	

\* P-value is significant at  $\leq 0.05$  level



This could be because studying nursing education is more accessible in many nursing institutes all over Yemen, while there are a limited number of nursing colleges that have opened in the last few years. This finding is nearly in line with a previous study<sup>16</sup> that reported most nurses had a diploma with one to four years of working experience. The results also revealed that 59.20% of ICU nurses had never taken any previous training courses on EN and 61.5% of them specified colleges and nursing institutes as the main sources of knowledge about the management of EN for them. This result is consistent to that of Mula<sup>22</sup>, who found that 72.5% of the participants obtained knowledge about EN during college studying or nursing schools. However, our results contradict the results by Ramuada<sup>23</sup> who found that in-service training courses (24.9%) was the most frequent source for knowledge, followed by colleges or schools of nursing education (20.6%).

The key finding in the current study was that the ICU nurses exhibited an inadequate level of knowledge concerning EN management. However, only 10.90% of the ICU nurses had an overall adequate level of knowledge regarding the EN management as a whole and the levels of adequate knowledge of it before administration, during administration and after administration were (16.10%, 5.80% and 9.20%, respectively). Such an inadequate knowledge among most Yemeni ICU nurses might be due to the inadequacy of in-service refreshing training courses or because hospitals have not a clear and updated guideline protocol that ICU nurses can access and adhere to at work. As mentioned above, 59.20% of ICU nurses had never engaged in training courses about EN, and most had a three-year nursing diploma and had five-years working experience or less, which supports our speculation. Our findings highlighted the gap in ICU nurses' knowledge regarding the EN management, which indicates the necessity for conducting in-service training courses that focus on EN management. The results are consistent with an earlier study<sup>10</sup> which assessed knowledge and practice among 85 nurses working in ICU concerning EN management. The result revealed that ICU nurses had a low and inadequate level of knowledge about EN management. In another similar study<sup>24</sup> that assessed nurses' knowledge and practice regarding use of a nasogastric tube (NGT) in medications administration for ICU patients, an unsatisfactory level of knowledge among nurses was found. Additionally, another study<sup>25</sup> assessing nurses' knowledge level about nutrition revealed that nurses had poor knowledge of nutrition. However, the results of the current study are inconsistent with the result of Al-Hawaly, Ibrahim and Qalawa<sup>18</sup> who found that the majority of the respondents had a satisfactory overall level of knowledge concerning NGT nutrition administering. Likewise, the result disagrees with the result of Carlos, Costa and Simino<sup>26</sup>, who registered a satisfactory level of nurses' knowledge concerning nutritional therapy.

Another key finding of this study is that the level of ICU nurses' knowledge regarding EN management was significantly associated with the educational level ( $\chi^2 = 13.141$ ,  $P = 0.011$ ). In other words, a high educational level in nursing was associated with a higher level of knowledge. This could be attributed

to the fact that faculties of nursing focus more on the theoretical aspect, while health institutes pay considerable attention to the practical aspect. This finding is similar to those of Abdullah *et al.*,<sup>24</sup> Shahin *et al.*,<sup>10</sup> and Taha and Said<sup>16</sup>, who found that the educational level was positively significant associated with the level of the nurses' knowledge about EN, whereas those who had a bachelor degree achieved a higher level of knowledge compared to those with less educational level. However, our finding was inconsistent with the results of Aml, Manal and Fatamah<sup>27</sup>, who reported no difference in knowledge level based on nurses' educational qualifications. This discrepancy is possibly because of the differences in the curriculum of educational institutions. Furthermore, it was found that a significant association between the knowledge level and the sources of information related to EN management ( $\chi^2 = 13.948$ ,  $P = 0.030$ ). The result implied that colleges and institutes of nursing represent the main source for respondents' knowledge about EN management. This result could be supported by the result of the present study as the majority (59.2%) of the respondents had never attended training courses related to EN management and only 7.5% of them used other resources for gaining knowledge about EN. Our result is in line with those of Abdullah *et al.*,<sup>24</sup> who found that doctors and previously working experience were the major sources for nurses' knowledge regarding EN management. The result also agrees with that of Morphet *et al.*<sup>17</sup> concerning colleagues as the main source of respondents' knowledge. Yet, this disagrees with that result concerning the hospital policies and protocols as the source for the respondents' knowledge about EN. In contrast, the result is incompatible with that found by Al Kalaladeh, Watson and Hayter<sup>28</sup>, as the researchers reported that the internet was the major source of knowledge about EN among the other sources for nurses.

On the other hand, there were no significant associations between the level of ICU nurses' knowledge regarding EN management and their age, sex, working experience and training courses about EN management. The results are consistent with those of Penland<sup>29</sup> in relation to the respondents' age, as the researcher reported that the respondents' knowledge level was not significantly associated with age. However, our results are in disagreement with the results of studies by Taha and Said<sup>16</sup> and Mooi<sup>30</sup> in relation to the nurses' age and years of working experience, as the researchers found that there was a highly statistically significant association between knowledge level regarding EN management and the respondents' age and previous working experience. This discrepancy might be attributed to the nature of training courses provided and the differences in the respondents' data, where it was found that young and newly graduated nurses had been more receptive, more tolerant and have a more potent memory.

The current study has some limitations that should be addressed in future research. The study was exclusive to assessment of nurses' knowledge in ICUs at public hospitals in Sana'a, the capital city of Yemen. Thus, the findings should be dealt with caution. Besides, future studies should evaluate nurses' practices in different hospitals and settings.

## Conclusions

Based on the findings of this study, it can be concluded that Yemeni ICU nurses had an inadequate level of knowledge about EN management. Accordingly, improving such knowledge regarding EN management is extremely needed. To this end, holding an in-service training courses in EN management among ICU Yemeni nurses and conduct such training courses on a regular basis are highly recommended.

## Data availability

### Underlying data

Figshare: ICU nurses' knowledge about EN. <https://doi.org/10.6084/m9.figshare.12542327><sup>21</sup>

This file contains the individual-level responses of all participants to each question asked.

### Extended data

Figshare: Questionnaire on ICU nurses' knowledge regarding EN. <https://doi.org/10.6084/m9.figshare.12643988><sup>19</sup>.

This file contains an English-language blank copy of the questionnaire used in this study.

Data are available under the terms of the [Creative Commons Attribution 4.0 International license](#) (CC-BY 4.0).

## Author contributions

GGA and TAHA developed the idea and design of the study. TAHA was responsible for data collection and data analysis. GGA has write up the manuscript. Both authors contributed to reviewing, drafting the manuscript and approved the final version.

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# Open Peer Review

Current Peer Review Status: ? X

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**Hiroyuki Ohbe** 

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The manuscript "Intensive care nurses' knowledge of enteral nutrition at public hospitals in Sana'a, Yemen: a cross-sectional survey" by Talal Ali Hussein Al-Qalah, *et al.* is a descriptive cross-sectional study from four public hospitals in the capital city of Yemen. The authors intended to assess the level of ICU nurses' knowledge regarding the management of enteral nutrition. The authors recruit 174 nurses in 2019. The authors found that 46% of them had an inadequate level of knowledge regarding enteral nutrition management. From my impressions, the aim of this study may not be interested in countries other than Yemen.

1. Introduction: Please clearly state "what is unknown" in their topic. It is unclear why the authors did this study.
2. Methods: Sample size determination: I'm not familiar with the equation the authors used. Can the authors provide the reference to support this sample size calculation?
3. Methods: Did the authors use the questionnaire which was previously developed or which was newly created? If the authors use the questionnaire which was newly created, how and why the authors could define that a score of 50% or less was considered inadequate, 51–75% moderate, while 76% and above was considered adequate. The cut-off score should be carefully selected.
4. Methods: Please clearly describe how to perform the multinomial logistic regression. How to obtain the p-values in Table 2? Multinomial logistic regression? Chi-square test?
5. Methods: Because the cells in Table 2 contained under <5, Fisher exact test is more suitable than chi-square test.
6. Discussion: If the authors used the different questionnaire used in the previous study, how and why the authors could compare the results?

7. Conclusions: Is there any evidence that training courses in EN management improve clinical outcomes? Based on the results of your study, the only thing the authors revealed was that low SES was associated with inadequate knowledge. Experience and training courses were not associated with improved knowledge. Therefore, the conclusion should be based on their results.
8. Discussion: What is new in this study? What can the readers act from this paper all over the world?

**Is the work clearly and accurately presented and does it cite the current literature?**

Partly

**Is the study design appropriate and is the work technically sound?**

Partly

**Are sufficient details of methods and analysis provided to allow replication by others?**

Partly

**If applicable, is the statistical analysis and its interpretation appropriate?**

Partly

**Are all the source data underlying the results available to ensure full reproducibility?**

Partly

**Are the conclusions drawn adequately supported by the results?**

Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Nutrition support in critically ill patients. Clinical epidemiology.

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.**

Author Response 26 Oct 2022

**Gamil Ghaleb Alrubaiee**

**COMMENT # 1:** Introduction: Please clearly state “what is unknown” in their topic. It is unclear why the authors did this study.

**RESPONSE:** Thank you for your comment. We agree with your comment that it was unclear in the introduction why the authors conducted the study, but it is stated clearly in the abstract.

Please refer to lines 2–4 in the background section. In response to your comment, we have

clarified in the introduction why the authors conducted this study. Please see paragraph 4, lines 10, 11, and 12 of the introduction.

**COMMENT # 2:** Methods: Sample size determination: I'm not familiar with the equation the authors used. Can the authors provide the reference to support this sample size calculation?

**RESPONSE:** Thank you for your comment. The equation we used to determine sample size in our study was found in many textbooks and cited by many other previous studies. We have included a reference according to your comment. Please see sample size determination section, lines 3.

**COMMENT # 3:** Methods: Did the authors use the questionnaire, which was previously developed, or which was newly created? If the authors use the questionnaire which was newly created, how and why the authors could define that a score of 50% or less was considered inadequate, 51–75% moderate, while 76% and above was considered adequate. The cut-off score should be carefully selected.

**RESPONSE:** Thank you for your comment. We did, in fact, use an adapted questionnaire and didn't develop a new one. The word "developed" is used incorrectly in this statement (A self-administered questionnaire was developed). We have changed the word "developed" by "adapted" to be clear. In addition, we have added cited studies based on Reviewer 2's comment. Please see study instrument section, lines 2.

The cut-off score used in this study as a scoring system was determined by previous studies rather than by the authors themselves. We already included the reference (Reference #22). Furthermore, many previous studies used a Bloom-based knowledge scoring system, we have added one of these studies. Please see the reference #23.

**COMMENT # 4:** Methods: Please clearly describe how to perform the multinomial logistic regression. How to obtain the p-values in Table 2? Multinomial logistic regression? Chi-square test?

**RESPONSE:** Thank you for your insightful observation and comment. In fact, we did not use multinomial logistic regression in our data analysis; instead, we used the Chi-square test to determine the relationships between ICU nurses' knowledge and the selected socio-demographic variables and obtain p-values. Based on your valuable input and that of Reviewer 2, the phrase "multinomial logistic regression" has been removed, and the analysis statement has been corrected. Please see data analysis section, lines 4.

**COMMENT # 5:** Methods: Because the cells in Table 2 contained under <5, Fisher exact test is more suitable than chi-square test.

**RESPONSE:** Thank you for your comment. We fully agree with you. We use the Fisher exact test to re-analyze the data in this table and re-write the table results accordingly. Please see Table 2. Please also see line 4 for the addition of this test to the data analysis section.

**COMMENT # 6:** Discussion: If the authors used the different questionnaire used in the

previous study, how and why the authors could compare the results?

**RESPONSE:** Thank you for your comment. Our questionnaire was not significantly different from those used in previous studies. We simply modified an existing questionnaire rather than creating a new one. As a result, we compared our study findings to those of related studies with similar intended outcomes.

**COMMENT # 7:** Conclusions: Is there any evidence that training courses in EN management improve clinical outcomes? Based on the results of your study, the only thing the authors revealed was that low SES was associated with inadequate knowledge. Experience and training courses were not associated with improved knowledge. Therefore, the conclusion should be based on their results.

**RESPONSE:** Thank you for your comment. Thank you for your comment. Our conclusion is derived from our results and there is no sentence implied that training courses in EN management improve clinical outcomes but improve the awareness and knowledge. This is what we concluded based on our findings and this is supported by many previous studies. Please see our conclusion section.

**COMMENT # 8:** Discussion: What is new in this study? What can the readers act from this paper all over the world?

**RESPONSE:** Thank you for your comment. This study, like many others around the world, has clear objectives. These are stated clearly at the end of the introduction section. These are explicitly stated at the end of the introduction. According to the study findings, we believe that the situation regarding Yemeni nurses' enteral nutrition care knowledge becomes clear. This would help decision makers develop a plan to fill this knowledge gap, and as a result, Yemeni nurses' knowledge would grow professionally, and they would be able to provide safe health care services. Furthermore, the findings of this study will serve as a data base for future research and will provide potential readers with information about the current situation of Yemen's nurses. We've added a paragraph to explain the study's implications. Please see the discussion section, paragraph 4, Lines 1-6.

**Competing Interests:** No

Reviewer Report 03 August 2020

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Khaled Mohammed Al-Sayaghi

1

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**Abstract:**

- The results part in the abstract should focus on the main results such as the areas with high level of knowledge and areas with lower level of knowledge. Remove the excessive description of the sample socio-demographic characteristic.
- Conclusion part has been written as a recommendation only. It will be better if you summarize the findings then make a brief recommendation.

**Methods:**

- Under the setting subtitle no need to mention the names of the hospitals. Maintaining the confidentiality of participant hospitals. No need to mention the duration of the study under the setting subtitle, it is mentioned under data collection.
- Delete this 'According to Al-Hawaly, Ibrahim, and Qalawa' and write : according to a previous study(·) ....
- Instead of citing the tool they have developed and used, authors must mention and cite the references and literature that had been used in developing the tool.
- Per authors, the second part of data collection instrument contains three subsections which are the before EN administration, during EN administration, and after EN administration. Accepting that this categorization is correct, it is not clear which items are under each subsection. Moreover, most of the 17 items are not related to the before, during, and after EN management, they are related to general knowledge about the EN (such as the indications, goals, benefits, complications, routs, methods, types and contents of EN formula, ..... etc.), even there is an item asking about the types of nutritional support in general (enteral, parenteral, combination, ..etc.). More suitable grouping and categorizing must be used to organize the instrument or to leave it without any categorization it will be better.
- Validity and reliability: delete the word 'reliability' and replace it by 'internal consistency'.
- Under the data analysis subtitle, they mentioned that a multinomial logistic regression test was conducted. In fact, no multinomial logistic regression test was done. So , delete 'multinomial logistic regression'.

**Results:**

- In results, the use of some terms (such as most, majority) in describing the results need a revision. For example: 49.40% is not a majority.
- Table 2 presents the frequency and percentage of the participants and compares between the subgroups using the Chi-square tests. I think it will be better if the table presents the knowledge means scores and standard deviations of the subgroups and compare between them by the t or f tests. After that multiple regression can be performed.



**Discussion:**

- Discussion must be on the main important findings based on the objectives of the study. No need to write two paragraphs at the beginning of the discussion about the participants' characteristics such as age, gender, educational levels, and work experience. Describing those characteristic in results part is enough.

**General**

- The paper needs English language editing.

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**

Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**

Partly

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Yes

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Critical Care and Emergency Nursing, Medical surgical Nursing, nutritional support in ICU

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

Author Response 26 Oct 2022

**Gamil Ghaleb Alrubaiee**

**COMMENT # 1:** Abstract: The results part in the abstract should focus on the main results such as the areas with high level of knowledge and areas with lower level of knowledge. Remove the excessive description of the sample socio-demographic characteristic.

**RESPONSE:** Thank you for your comment. The results section has been rewritten based on your recommendation. Please see the abstract's results section.

**COMMENT # 2:** Conclusion part has been written as a recommendation only. It will be better if you summarize the findings then make a brief recommendation.

**RESPONSE:** Thank you for your comment. Indeed, the findings were summarized in the results section, and the conclusion section focused on the main result, the knowledge gap, and the recommendations based on that result.

**COMMENT # 3:** Methods: Under the setting subtitle no need to mention the names of the hospitals. Maintaining the confidentiality of participant hospitals. No need to mention the duration of the study under the setting subtitle, it is mentioned under data collection.

**RESPONSE:** Thank you for your comment. We have followed your recommendations.

**COMMENT # 4:** Delete this 'According to Al-Hawaly, Ibrahim, and Qalawa' and write : according to a previous study(..)

**RESPONSE:** Thank you for your comment. We have followed your recommendations.

**COMMENT # 5:** Instead of citing the tool they have developed and used, authors must mention and cite the references and literature that had been used in developing the tool.

**RESPONSE:** Thank you for your comment. The references for adapted tool were cited as recommended.

**COMMENT # 6:** Per authors, the second part of data collection instrument contains three subsections which are the before EN administration, during EN administration, and after EN administration. Accepting that this categorization is correct, it is not clear which items are under each subsection. Moreover, most of the 17 items are not related to the before, during, and after EN management, they are related to general knowledge about the EN (such as the indications, goals, benefits, complications, routes, methods, types and contents of EN formula, ..... etc.), even there is an item asking about the types of nutritional support in general (enteral, parenteral, combination, ..etc.). More suitable grouping and categorizing must be used to organize the instrument or to leave it without any categorization it will be better.

Instead of citing the tool they have developed and used, authors must mention and cite the references and literature that had been used in developing the tool.

**RESPONSE:** Thank you for your comment. The items under each subsection were mentioned to be clear for the potential readers. We also replace the word "management" by "care" to be consistent with the general knowledge about the care of EN.

**COMMENT # 7:** Validity and reliability: delete the word 'reliability' and replace it by 'internal consistency'.

**RESPONSE:** Thank you for your comment. We removed the word "reliability" and replaced it with "internal consistency."

**COMMENT # 8:** Under the data analysis subtitle, they mentioned that a multinomial logistic regression test was conducted. In fact, no multinomial logistic regression test was done. So, delete 'multinomial logistic regression'.

**RESPONSE:** Thank you for your comment. We apologize for mistyping a multinomial logistic regression test. We have removed the term "multinomial logistic regression".

**COMMENT # 9:** Results: In results, the use of some terms (such as most, majority) in describing the results need a revision. For example: 49.40% is not a majority.

**RESPONSE:** Thank you for the comment. We have corrected some terms as recommended.

**COMMENT # 10:** Table 2 presents the frequency and percentage of the participants and compares between the subgroups using the Chi-square tests. I think it will be better if the table presents the knowledge means scores and standard deviations of the subgroups and compare between them by the t or f tests. After that multiple regression can be performed.

**RESPONSE:** Thank you for your comment. Following the recommendation of Reviewer 1, we re-analyze the data in Table 2 using the Fisher exact test rather than the Chi-square test. Please see Table 2.

**COMMENT # 11:** Discussion: Discussion must be on the main important findings based on the objectives of the study. No need to write two paragraphs at the beginning of the discussion about the participants' characteristics such as age, gender, educational levels, and work experience. Describing those characteristic in results part is enough.

**RESPONSE:** Thank you for your comment. Based on your recommendation, the two paragraphs about socio-demographic characteristics were removed from the discussion section.

**COMMENT # 12: General:** The paper needs English language editing.

**RESPONSE:** Thank you for your comment. The manuscript was reviewed and edited as your recommendation.

**Competing Interests:** no

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