

NURSES' KNOWLEDGE AND SKILLS ABOUT MEDICATION ADMINISTRATION BY ENTERAL FEEDING TUBE: INFLUENCE OF GUIDELINES INTERVENTION

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Abstract

Medications administration through enteral feeding tube seems to be a challenge, if medications are not given appropriately through the enteral route, it may result in harmful consequences. **Aim:** The aim of this study was to evaluate the influence of intervention guidelines on nurses' knowledge and skills about medication administration by enteral feeding tube. **Research hypotheses:** The current study hypothesized that: Implementing guidelines intervention about medication administration by enteral feeding tube will affect nurses' knowledge and skills positively. **Design:** A quasi experimental design (one group pretest- posttest) was utilized in this study. **Subjects:** A convenient sample of all available nurses (50 nurses). **Setting:** The study was conducted at medical and surgical intensive care units at Kafr Elsheikh University hospital. **Tools:** Two tools were used, a nurses' knowledge assessment questionnaire and nurses' observational checklist. **Results:** the result showed that mean age of studied nurses was 31.82 ± 7.61 . While, 62% of them were males, and 86% had bachelor degree in nursing. The study revealed that 100% of the studied nurses had a satisfactory level of knowledge about medication administration by enteral feeding tube post implementation of intervention guidelines and 84% of the studied nurses had a satisfactory level of skills about medication administration by enteral feeding tube post guidelines implementation. **Conclusion:** Based on the results of the present study, it can be concluded that implementing intervention guidelines about medication administration by enteral feeding tube had a positive effect on nurses' knowledge and skills. There was a statistically significant difference between nurses' knowledge and skills post guidelines intervention at $p \leq 0.001$. **Recommendations:** Continuous training programs for nurses to improve and update nurses' knowledge and skills about safe administration of medication by enteral feeding tube, Provision of nurses with simple illustrated booklet and posters about medications administration by enteral route and food-drugs interactions, and further studies should be carried out in different settings on a larger sample to be able to generalize the results.

Index Terms: Enteral Feeding Tube, Intervention Guidelines, Medication Administration, Nurses' Knowledge and Skills.

1. INTRODUCTION

Enteral feeding tube (EFT) refers to intake of food by the gastrointestinal (GI) tract through a thin liable plastic tube that can be inserted in patient nose and advanced into the

stomach. It may be ordered by health care provider (21). The enteral route is the most physiological and safest alternative route in relation to contamination risks and also represents a lower cost when compared to parenteral nutrition. Some patients are incapable of swallowing medications though. In these cases, nasogastric or nasoenteric tubes (NGT/NET) are valid alternatives. Not all pharmaceutical forms are safe for administration through an NGT/NET. Frequently, more than one oral medication is prescribed and scheduled for the same administration time, as well as modified release drug forms are often prescribed for patients using an NGT/NET. Such actions bring potential risk to patients and contribute to patient safety incidents, including drug interactions, toxicity or tube obstruction (5).

Medication errors related to feeding tube route happen more often than reported or recognized. These errors are often the result of administering medications that are incompatible with administration by enteral feeding tube, preparing the medications improperly, and/or administering a drug using improper administration techniques. Errors occurring in oral medication preparation and administration can lead to an occluded feeding tube, reduce the effects of drugs, lead to unsuccessful treatment of patient, and increase the risk of potential adverse drug reactions, these errors include lack of drug knowledge among physicians, inadequate training of nurses and lack of pharmacists' participation in medical setting (21).

Nurses play an important role in patients' medication process, and medication administration (MA). Nurses' medication competence consists of three major categories: theoretical, practical and decision-making competence. Medication administration-related activities are divided into seven areas: obtaining and verifying medications, medication delivery, information retrieval, management of physician's orders, documentation of medication administration, activities uncharacterized by observer and inefficient waiting (22).

The purpose of enteral tube guidelines is to provide guidance on the safe and effective use of enteral tubes for the delivery of nutrition and/or medication to patients. These guidelines may cover a range of topics, including indications for enteral tube placement that may provide information on when enteral tube placement is appropriate, such as for patients who are unable to consume enough food or fluids by mouth. Guidelines may provide recommendations on the appropriate type of tube to use, such as nasogastric, nasojejunal, or gastrostomy tubes, as well as the proper technique for tube placement (27).

2. SIGNIFICANCE OF THE STUDY

The enteral route has become a standard of care to deliver nutrition support for hospitalized patients in the intensive care unit (ICU) who cannot eat. Enteral nutrition is preferred over parenteral nutrition because it maintains intestinal integrity and causes less infectious complications. The same access device is increasingly being used to deliver medications which provides cost savings but also creates new challenges (6).

In the intensive care unit (ICU), medication preparation and administration are carried out by nurses and each nurse performs that based on their experience, habit, and personal information, not according to standard protocols. Unfortunately, no standard protocol was defined (2). So, providing training programs/ sessions for nurses regarding safe medications administration by enteral feeding tube to enhance their knowledge and improve their skills; in addition to the availability of printed universal guidelines illustrated simply in posters and booklets for guiding nurses' skills regarding medications administration by nasogastric tube are considered important.

3. AIM OF THE STUDY

The aim of this study was to evaluate the influence of intervention guidelines on nurses' knowledge and skills about medication administration by enteral feeding tube through:

- 1) Assessing nurses' knowledge about medication administration by enteral feeding tube.
- 2) Assessing nurses' skills about medication administration by enteral feeding tube.
- 3) Developing and implementing intervention guidelines about medication administration by enteral feeding tube.
- 4) Evaluating the influence of interventional guidelines about medication administration by enteral feeding tube on knowledge and skills of nurses.

4. RESEARCH HYPOTHESES

The current study hypothesized that:

- H1. Implementing intervention guidelines about medication administration by enteral feeding tube will affect nurses' knowledge positively.
- H2. Implementing intervention guidelines about medication administration by enteral feeding tube will affect nurses' skills positively.

5. SUBJECTS AND METHODS

5.1 Research design

A quasi experimental design (one group pretest- posttest) was utilized to achieve the aim of this study.

5.2 Research setting

This study was conducted in the Medical Intensive Care Unit (MICU) and Surgical Intensive Care Unit (SICU) at Kafr Elsheikh University Hospital.

5.3 Subjects

A convenient sample of all available nurses in the previously mentioned settings during the time of carrying out this study. The subject included 50 critical care nurse (28 from the MICU, and 22 from the SICU) who were willing to participate in this study.

5.4 Tools of data collection: Two tools were used to collect data for this study:

Tool 1: Nurses' Knowledge Assessment Questionnaire: This tool was adapted from (12 and 4) based on reviewing related literature and it consists of two parts:

Part I: Demographic characteristics: This part was used to assess age, gender, marital status, educational qualifications, place of work, years of experience, and previous training on medication administration. It includes seven multiple choice questions (MCQs).

Part II: Nurses' knowledge assessment regarding medication administration: This part was used to assess nurses' level of knowledge regarding medication administration by enteral feeding tube (EFT). It included 35 MCQs divided under five main sections (general knowledge about NGT composed of seven MCQs, role of nurses during preparation of medication composed of four MCQs, planning of medication administration composed of seven MCQs, administering medication composed of fourteen MCQs and evaluation of medication administration by EFT composed of three MCQs).

Scoring system:

Regarding scoring system of nurses' knowledge assessment: This part consisted of 35 questions in form of multiple choices. The response to each item is by choosing the correct answer, each correct answer was given one grade while the incorrect answer was given zero.

The total score for nurses' knowledge assessment was calculated for every nurse and categorized into satisfactory and unsatisfactory level of knowledge as follow:

- $\geq 85\%$ was considered satisfactory level of knowledge (≥ 30 out of 35 grades).
- $< 85\%$ was considered unsatisfactory level of knowledge (< 30 out of 35 grades).

Tool 2: Nurses' Observational Checklist: This tool was adapted from (3 and 16) based on reviewing related literature. It was used to assess nurses' skills regarding medication administration by EFT. It consisted of 40 steps divided into 5 sections according to the five main phases of medication administration that includes: assessment phase included 6 steps, planning phase included 5 steps, implementation phase included 20 steps, evaluation phase included 5 steps, and documentation phase included 4 steps.

Scoring system:

Regarding scoring system of nurses' observational checklist. This tool consisted of 40 steps. The response to each step was by checking done correctly or done incorrectly or not done. The responses were graded as follow: the step that done correctly was given one grade and zero for steps that done incorrectly or not done.

The total score for nurses' observational checklist was calculated for every nurse and categorized into satisfactory and unsatisfactory level of skills as follow:

- $\geq 90\%$ was considered satisfactory level of skills (≥ 36 out of 40 grades).
- $< 90\%$ was considered unsatisfactory level of skills (< 36 out of 40 grades).

5.5 Operational Design:

The operational design included preparatory phase, content validity and reliability, pilot study and the field work.

5.5.1 The preparatory Phase: This phase was carried out through the following steps:

- Reviewing of the related literature, and theoretical knowledge of various aspects of the study using books, articles, internet, periodicals and magazines to develop tools of data collection.
- Outlining all areas to be included in the guidelines of the medication administration by enteral feeding tube through extensive review of the literature and other available resources.
- Preparing and designing the content of guidelines for medication administration by enteral feeding tube.
- Obtaining experts' opinion to ensure the validity of the content of the medication administration guidelines by enteral feeding tube.

5.5.2 Validity of the study tools:

Content validity is defined as the extent to which the items in the instrument reflect the content universe to which the instrument was generalized (8). Validity of the developed tools was tested using face and content validity. To assess the content validity of these tools, a jury of five experts from different academic categories, including two professors and three assistant professors of medical surgical nursing department at the Faculty of Nursing of Ain Shams University was selected. The experts reviewed the tools for clarity, relevance, comprehensiveness, simplicity, and minor modifications were made. This stage was essential to ensure that the tools were effective in achieving the intended purpose.

5.5.3 Reliability of the tools:

Reliability is defined as the overall consistency of a measure. It is the degree in which a phenomenon measurement offers a stable and a consist result (20). The reliability of the tools was assessed for internal consistency by using Cronbach alpha test and it was 0.864 for part II of nurses' knowledge assessment questionnaire, and 0.879 for nurses' observational checklist, and 0.868 for all tools.

5.5.4 Pilot study:

The pilot study was carried out on 10% (5 nurses) of the total study subjects to test study tools in terms of its clarity and objectivity. The Pilot study was conducted at the previously

mentioned setting that was visited to assess the applicability of the used tools. According to analysis of the results, modification of the tool content was done. Pilot study subject was not included in the final total subject.

5.5.5 Field Work:

The study was started and finished through the following phases.

Assessment and planning phase:

- The researcher met the ICU nurses at Kafr Elsheikh University hospital.
- The researcher obtained their oral consent for participating in the study after explaining the aim.
- The researcher visited the selected settings two days/ week (Monday and Thursday) in the morning shift from 11:00 am to 1:00 pm and in the afternoon shift from 4:00 pm to 6:00 pm.
- Each nurse was observed by the researcher through the whole process of medication administration by enteral feeding tube to assess medication administration by enteral feeding tube according to observational checklist.
- The researcher observed about 2 or 3 nurses each day, the average time for observation was 30 minutes for each nurse.
- All nurses in the units were observed in the same manner until the study subjects was completed.
- The researcher distributed the nurses' knowledge assessment questionnaire and it was filled by nurses.
- All information collected through the study tools were interpreted to identify the individual learning needs for nurses to be a base for designing the intervention guideline contents.
- The researcher set up the training sessions plan and determined the required resources and facilities for applying the interventional guidelines for medication administration by enteral feeding tube such as the printed material, power point presentation, videos and location of sessions, and posters.
- The time for starting the teaching sessions was determined and scheduled with the nursing staff and managerial staff and agreed to be two days per week.

Developed nursing guidelines for nurses for medication administration by enteral feeding tube:

The intervention guidelines were developed based on reviewing the related literatures (11, 14, 15, 23 and 25). It was developed in an Arabic language using illustrated pictures and it was consisted of two parts.

Part one: theoretical part contains knowledge about drug administration by enteral feeding tube, which included overview about:

- Anatomy of GIT.
- Physiology of GIT.
- Introduction about enteral feeding tube.
- Purposes of enteral feeding tube.
- Indications of enteral feeding tube.
- Contraindication of enteral feeding tube.
- Sizes of enteral feeding tube.
- Types of gastric tubes (indication and complication).
 1. Nasogastric tube
 2. Nasojujinal tube.
 3. Gastrostomy tube.
 4. Jejunostomy tube.

Part two: practical part contains guidelines related to methods of drug administration by enteral feeding tube.

- Drug administration by enteral tube.
- Definition of medication.
- Routes of drug administration.
- Oral route.
- Drug interaction.
- Intervention guidelines of drug administration by enteral feeding tube.
- Nursing role in drug administration by enteral feeding tube.
 1. Assessment phase.
 2. Planning phase.
 3. Implementation phase.
 4. Evaluation phase.
 5. Documentation phase.
- Problems associated with drug administration by enteral tube.

Implementation phase:

- Implementation of the training guidelines for the nurses in the two units continued over a period of 4 weeks. Number of sessions were seven sessions that divided into one opening session, two sessions for theory, three sessions for skills and one session for revision and evaluation of the training program, at the morning and afternoon shifts.
- The teaching sessions were conducted in a classroom of each unit. The classroom was quiet, had adequate lighting, well ventilated, comfortable chairs, and had adequate space for implementing the practical part of the training program.
- The duration of each session took about 30 minutes to 45 minutes / day (30 minutes for the opening session and 30 minutes for the closing session and 45 minutes for other sessions). These sessions were conducted for eight small groups of nurses; each group included six to seven nurses. Each session was repeated in the days of visit in each unit to cover the nurses in all groups and according to the plan of each ICU.
- At the beginning of each session, an orientation of the importance of medication administration by enteral feeding tube guidelines was explained to the nurses to motivate them to follow the guidelines' content.
- Each session started by greeting the staff nurses, assessing their motivation for learning, showing the objectives, and explaining the topic by using simple language to suit the understanding level of all subjects.
- The researcher got feedback from nurses at the end of each session and reinforce them to ask questions to clarify any misunderstanding points.
- The teaching methods and media that used during the training program included; lectures, group discussion, demonstration and re-demonstration.

Evaluation phase:

The evaluation phase emphasized on evaluating the effect of medication administration by enteral feeding tube interventional guidelines on nurses' knowledge and skills. It was evaluated immediately after guidelines implementation using the same tools that were used in the assessment phase. The collected data before and after the implementation of the intervention guidelines was compared.

5.6 Administrative Design

An official letter was issued from the dean of faculty of nursing to the head nurse of each unit, and the medical and nursing director of Kafr Elsheikh University Hospital at which the study was conducted, explaining the purpose of the study to obtain their permission to conduct this study.

5.7 Ethical considerations:

The ethical considerations in this study included the following: The study approval was obtained from Scientific Research Ethical Committee at Faculty of Nursing of Ain-Shams University before starting the study, the researcher clarified the objective and aim of the study to the nurses included in the study, the researcher assured maintaining anonymity

and confidentiality of the studied subjects, and the studied subjects were informed that they are allowed to choose to participate in the study or not and they have the right to withdraw from the study at any time without any harm.

5.8 Statistical Design:

Data was collected, tabulated and subjected to statistical analysis. Statistical analysis was performed using SPSS (version 20), in addition to Microsoft Office Excel that is used for data handling and graphical presentation. Quantitative variables are described by the Mean, Standard Deviation (SD), comparison was done using X^2 test, while qualitative categorical variables are described by proportions and percentages. Chi-square test was used for categorical variables. Regarding significance of the results, the observed differences and associations were considered as follows:

- Non-significant $P > 0.05$
- Significant $P \leq 0.05$
- Highly significant $P \leq 0.01$.

6. RESULTS

Table 1: Percentage distribution of the demographic characteristics of the studied nurses (N=50)

Demographic characteristics	N	%
Age		
≤ 25 years	9	18.0
> 25 < 35 years	27	54.0
≥ 35 years	14	28.0
Mean + SD	31.82±7.61	
Gender		
Male	31	62.0
Female	19	38.0
Marital Status		
Single	33	66.0
Married	14	28.0
Divorced	1	2.0
Widow	2	4.0
Educational qualification		
Bachelor degree	43	86.0
Technical health institute of nursing	6	12.0
Diploma in nursing	1	2.0
Place of work		
Medical intensive care unit	28	56.0
Surgical intensive care unit	22	44.0
Years of experience		
1-<5 years	45	90.0
≥5-<10 years	4	8.0
≥10 years	1	2.0
Attended training courses		
No	31	62.0
Yes	19	38.0

Table 1 shows that 54% of the studied nurses were in the age of > 25 <35 years with mean age 31.82 ± 7.61 . In relation to gender, 62% were males, 66% were single, and 86% had bachelor degree in nursing. Regarding the place of work, it was found that 56% of nurses were working at the medical intensive care unit. Concerning years of experience, it was revealed that 90% of nurses had 1-<5 years of experience, and 62% of the studied nurses didn't attend any training courses about drug administration by enteral feeding tube.

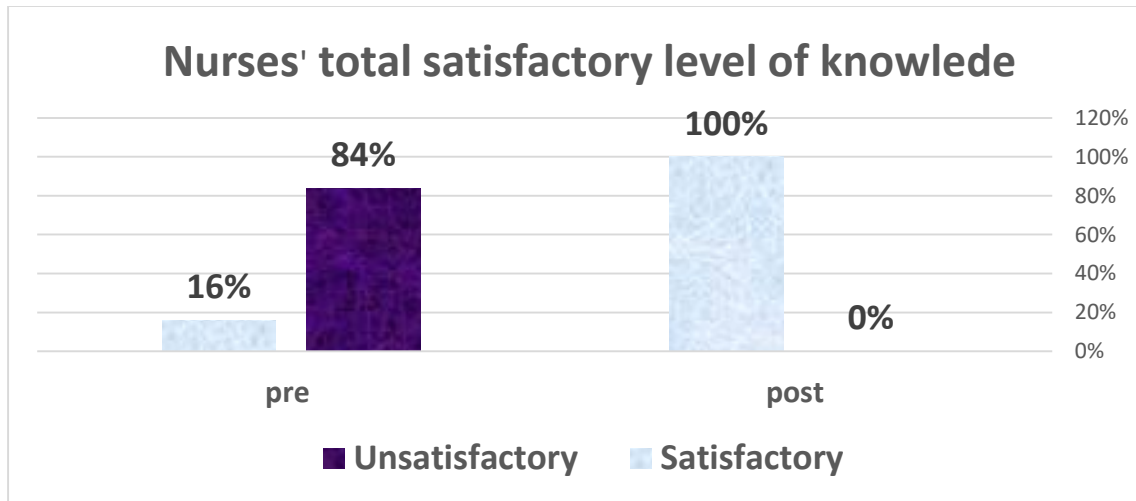


Figure 1: Total satisfactory level of knowledge for nurses pre and post implementation of intervention guidelines about medication administration by enteral feeding tube (N=50)

Figure 1 illustrates that all 100% of the studied nurses had a satisfactory level of knowledge about medication administration by EFT post implementing of intervention guidelines compared with pre intervention that represent 16%.

Table 2: Percentage distribution of nurses' knowledge about medication administration by enteral feeding tube pre and post implementing intervention guidelines (N=50)

Knowledge of nurses during medication administration by EFT	Pre				Post				Pre- post Test	
	Correct		Incorrect		Correct		Incorrect		χ^2	P value
	N	%	N	%	N	%	N	%		
General knowledge about EFT.	18	36	32	64	49	98	1	2	43.46	0.000*
Nurses' role during the preparation stage of medication administration by EFT.	3	6	47	94	46	92	4	8	73.99	0.000*
Nurses' role during the planning stage of medication administration by EFT.	4	8	46	92	49	98	1	2	81.29	0.000*
Nurses' role during the implementation stage of medication administration by EFT.	2	4	48	96	50	100	0	0	92.30	0.000*
Nurses' role during the evaluation stage of medication administration by EFT.	25	50	25	50	50	100	0	0	26.83	0.000*

* $P \leq 0.001$ highly significant

Table 2 shows that all (100%) of the studied nurses had correct knowledge about their role during the implementation, and evaluation stages of medication administration by EFT post implementation of interventional guidelines respectively, compared with 4% and 50% before implementing intervention guidelines. In addition, 92% of nurses had correct knowledge post interventional guidelines implementation about their role during the preparation stage of medication administration by EFT compared with 6% pre guidelines implementation with a highly statistically significance difference between pre and post guidelines intervention implementation at p value < 0.001.

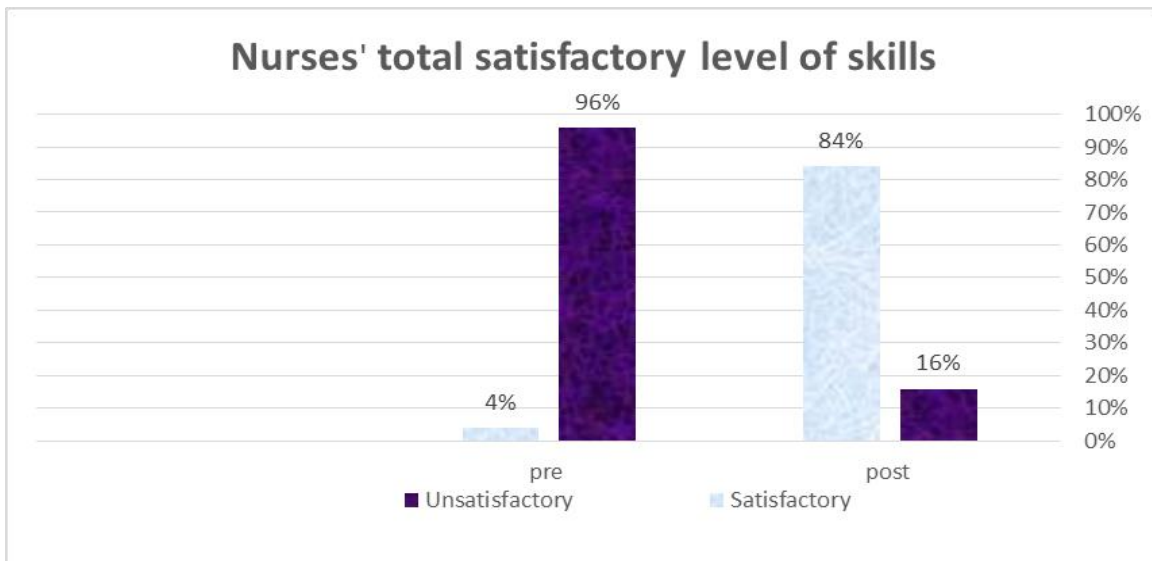


Figure 2: Total nurses' satisfactory level of skills about medication administration by enteral feeding tube pre and post intervention implementation (N=50)

Figure (2) illustrates that the majority 84% of the studied nurses had a satisfactory level of skills about medication administration by EFT post guidelines intervention implementation compared with 4% before guidelines implementation.

Table 3: Percentage distribution of nurses' skills about medication administration by enteral feeding tube pre and post implementing intervention guidelines (N=50)

Nurses' skills through medication administration phases by EFT	Pre				Post				Pre- post Test	
	Done		Not done		Done		Not done		χ^2	P value
	N	%	N	%	N	%	N	%		
Assessment phase	3	6	47	94	44	88	6	12	67.48	0.000*
Planning phase	2	4	48	96	46	92	4	8	77.56	0.000*
Implementation phase	1	2	49	98	45	90	5	10	77.93	0.000*
Evaluation phase	11	22	39	78	43	86	7	14	41.22	0.000*
Documentation	5	10	45	90	42	84	8	16	54.95	0.000*

*P≤ 0.001 highly significant

Table 3 shows a highly statistically significant difference in nurses' skills through all phases of medication administration by EFT (assessment, planning, implementation,

evaluation, and documentation) at p value < 0.001 . The table illustrated that 92% of the studied nurses perform the steps of planning phase correctly of medication administration by EFT compared with 4% before implementation of intervention guidelines. And 84% of them are demonstrated correctly the steps of documentation phase of medication administration by EFT post implementation of intervention guidelines, compared with 10% before guidelines implementation.

Table 4: Correlation between knowledge and skills among the studied nurses pre and post implementation of guidelines intervention about medication administration by enteral feeding tube (n=50)

Parameters	Skills pre		Skills post	
	r	P	r	P
knowledge	0.086	0.550	0.270	0.018*

Table 4 shows a statistically significant correlation between total nurses' knowledge and total level of skills post guidelines intervention implementation at p value ≤ 0.001 . While there is no statistically significance correlation between total nurses' knowledge and total level of skills pre guidelines intervention implementation.

7. DISCUSSION

Administering medications by enteral feeding tube is a key duty of nurses in intense care settings and vital to ensure that they do this correctly. Medications administration by EFT seems to be a challenge, if medications are not given appropriately by the enteral route, it may result in harmful consequences. Therefore, this demands a more efficient performance by the nursing staff, in order to achieve optimum results "Boullata (13)". Therefore; the current study was carried out to evaluate the influence of intervention guidelines on nurses' knowledge and skills about medication administration by enteral feeding tube.

As regard demographic data of the studied subjects, the study results revealed that more than half of the studied subjects age ranged from 25-35 years, with mean age of 31.82 ± 7.61 , two thirds of the subjects were males, and singles, majority of the subjects held a Bachelor's degree, about half of the subjects had years of experience of working in the ICU that ranged from one years to less than five years, and less than two thirds of the studied nurses had not received any training courses. This finding aligned with a study conducted by "Abd Elgwad et al., (26) in a study titled "Effect of Medication Safety Guidelines on Prevention of Medication Errors among Nurses in the Intensive Care Unit" who reported that age of the sample was twenty-five to less than thirty years and that approximately half of the ICU staff nurses had years of experience ranged from one to five years. Also, "Salem et al., (17) who reported that the majority of the subjects were females most of subjects had a Bachelor's degree of nursing.

In addition, this finding supported by "Sari et al., (7) whose study entitled "Intensive care unit nurses' knowledge of medication administration via enteral tubes" showed that the mean years of experience was 8.45 ± 6.47 years, and the mean experience for nurses

was 4.90 ± 4.99 years. And this finding was consistent with the results of a study conducted by "Abu Hdaib et al., (19)" who found that more than three quarters of the nurses had not have any training courses about drug administration by EFT. But, contradicted to "Abd Elgwad et al., (26)" who mentioned that more than two thirds of the sample were females. And "Salem et al., (17)" who reported most of them were married. From the researcher's point of view, this might be due to that the hospital in which the study was carried out is newly established and most of nursing staff were newly graduated and hired.

In relation to the total nurses' knowledge about medication administration by EFT, the current study results showed that all of the studied nurses had correct knowledge and a satisfactory level of knowledge after the implementation of the guidelines. From the researcher's point of view, this might be due to that nursing staff were newly graduated and hired and working by their experience and knowledge from their undergraduate study/experience and this highlighted the differences in the experience levels of nurses' knowledge and skills. And nurses are keen to attend the training about the guidelines to improve their performance in order to maintain the lives of patients and well-being. This means that guidelines implementation had significantly improved nurses' knowledge about enteral feeding tube. So, the hypothesis of implementing intervention guidelines about medication administration by enteral feeding tube would affect nurses' knowledge positively is accepted.

In the same line, the present results were congruent with "Ahmed et al., (9) titled "Effect of Educational Nursing Guidelines Regarding Enteral Feeding on Nurses' Knowledge and Skills at Critical Care Units" who reported that the majority of nurses had unsatisfactory total knowledge score before the implementation of guidelines with a mean score was 60.0 ± 31.2 . While, post guidelines implementation, it was 109.9 ± 19.2 .

Regarding nurses' general knowledge about EFT, the study findings indicated that most of the studied nurses had acquired the correct knowledge following the intervention guidelines implementation. These findings were consistent with "Ahmed et al., (9)" who reported that the nurses' knowledge mean score pre guidelines implementation was 5.3 ± 2.3 . However, after the implementation of guidelines, there was a significant improvement in knowledge, with a mean score of 8.7 ± 1.4 .

Regarding nurses' knowledge about the planning stage of medication administration by EFT, it's noteworthy that all ICU staff nurses demonstrated correct knowledge post implementation of the intervention guidelines. From the researcher's point of view, the high level of correct knowledge post implementation of the intervention guidelines can be attributed to several factors as, the repetition of the concept during each session of the training program and motivation given to nurses in order to engage actively and retain the information presented during the training. Before implementation of intervention guidelines, the result of the study found that most of the studied staff nurses didn't know the correct nursing action should be done related to planning stage of medication administration by enteral feeding tube, and almost all of them answered the same questions correctly after the intervention. These results were in line with the study done

by "Tillott, et al., (12) entitled "Survey of nurses' knowledge and skills regarding medication administration using enteral tubes", who reported that little of the subject didn't know what to do when the medication was recommended to be taken through enteral feeding tube.

In relation to the implementation stage nurses knowledge about medication administration by the EFT, the results of current study showed that all of nurses had got the correct knowledge post intervention guidelines implementation compared to few nurses before implementation of the intervention guidelines. These results were congruent with "Chen et al., (29) titled "Improving Nurse Skill of Medication Administration by Enteral Feeding Tube "who stated that the trainees' error rate concerning knowledge about implementation stage drug fell from more than fifth before implementation of education sessions to 2.5% after the implementation of education sessions.

Regarding the evaluation stage nurses knowledge about drug administration by EFT, the present study showed that half of nurses answered correctly the questions related to evaluation stage pre guidelines implementation, while all of them answered correctly post implementation. These results were congruent with "Sari et al., (7)" who found that the majority of nurses stated that they evaluate the potential complications after administered medication by EFT to prevent the drug-drug interactions.

On investigating nurses' total practices about medications administration by enteral feeding tube, the majority of the studied subjects had a satisfactory level of skills after intervention guidelines implementation. While, most of them had got unsatisfactory practice level before the implementation of the guidelines. The low skills level about medication administration by enteral feeding tube may be due to the studied subjects were have not enough knowledge, shortage of nursing staff in relation to numbers of patients in ICU, lack of continuous evaluation of nurses' practices and opportunities for attending training course. According to experiential learning theory, practice makes perfect and experience is the best teacher. The person must learn by doing things. So, the hypothesis of Implementing intervention guidelines about medication administration through enteral feeding tube would affect nurse' skills positively is accepted.

These results were congruent with "Mohammed et al., (28)" who reported that the majority of the studied sample had unsatisfactory skills in various domains of drug administration via enteral catheters in the pre-test of the instructive program. While, these study findings are contradicted with "Shahin et al., (18)" who carried a study on 85 critical care nurses who stated that the greater part of nurses had agreeable level of practice related to drug administration via enteral catheters in the pre-test of the instructive program.

Concerning nursing practices during the planning phase of medication administration by EFT pre and post guidelines intervention, that the current study found that few of nurses perform the steps correctly before the guidelines implementation. However, after the guidelines were applied, most of nurses were doing it correctly. This result is agreed with "Attia et al., (10)" who noted that more than half of studied nurses had unsatisfactory level

of practice score regarding planning steps pre guidelines implementation, while post guidelines implementation, there was an improvement in total nurses' practices score. This may be due to poor skills, workload, lack of concentration and lack of experience. While post guidelines implementation, there was an improvement in total nurses' practices score which reflects the positive effect of nursing guidelines on nurses' practice during caring for.

Concerning nursing practices during the implementation phase of medication administration by EFT, the current study found that about all of the studied subjects didn't perform the steps of implementation correctly compared to most of them perform the steps correctly. These results were in the same line with "Abo Jeesh et al., (1)" who conducted a study titled "The Effect of An Educational Program on Nurses' Practices Regarding the Implementation of Patient Care and Safety Measures During Nasogastric Tube Feeding in The Critical Care Units in Syria" reported that regarding the implementation, before the program, the results show that the nurses ignored and didn't implement most steps of this stage in the correct way and the results showed that there were variations of the nurses' improvement in all steps after the program, and the nurses' scores were varied from 35-80 with mean of 50.69 ± 10.35 before the program to 54-89 with mean of 72.10 ± 9.07 after the program.

In relation to documentation skills of medication administration by EFT, the results showed that few numbers of the studied subjects did it correctly before the implementation of the intervention guidelines. While, most of them did it post implementation of guidelines. These results were contradicted with "Luokkamäki et al., (22)" who reported that two thirds of nurses always document their notes about medication administrations.

Regarding the relationship between knowledge and skills among the studied nurses pre and post implementation of guidelines intervention, the result showed that there was a statistically significant correlation between nurses' knowledge and skills post guidelines implementation. These results might be due to that improving level of knowledge lead to increase level of skills because nurses applied what they taught after implementation of intervention guidelines. This result is congruent with "Taher et al., (24)" who reported that the mean scores for nurses' skills about different stages of drug administration by enteral tube increased significantly after the training program in the case group. Also, "Abd Elgwad et al., (26)" reported that there was a highly significant positive correlation between total knowledge and total skills pre and post guidelines application.

8. CONCLUSIONS

Based on the results of the present study, it can be concluded that implementing intervention guidelines about medication administration by enteral feeding had positive effect on nurses' knowledge and skills which support the two hypotheses of the current study. There was a statistically significant correlation between nurses' knowledge and skills post guidelines intervention where $p \text{ value} \leq 0.001$.

9. RECOMMENDATION

The study recommended the following items:

1. Continuous training programs should be conducted to improve and update nurses' knowledge and skills about safe administration of medication administration by enteral feeding tube.
2. Provision of nurses with simple illustrated booklets and posters related to medications' administration by enteral route and food-drugs interactions.
3. Further study could be carried out in different settings and on a larger sample in order to achieve generalization of the results.

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References

- 1) Abo Jeesh Y. A., Khalid E. F., Elbashier I. M., "The Effect of An Educational Program on Nurses' Practices Regarding the Implementation of Patient Care and Safety Measures During Nasogastric Tube Feeding in The Critical Care Units in Syria", *European Scientific Journal*, 2021, 17(29), 59.
- 2) A., Mohammed, "Assessment of Nurses' Knowledge and practices Regarding Enteral Tube at Neonatal Intensive Care Unit in Baghdad Hospitals", *Indian Journal of Public Health Research and Development*, 2019, 10, 4, pp 127-130.
- 3) B. Timby, "Medication Administration, Fundamental of Nursing Skills and Concepts", 10th ed, Wolters Kluwer Health, Lippincott Williams and Wilkins, U.S.A., 2013, pp473-750.
- 4) C. Taylor, C. Lilfis P. Le mone and P. Lynn, "Medication Administration, Fundamentals of Nursing the Art of Science of Nursing Care", 7th ed, Wolters Kluwer Health, Lippincott Williams and Wilkins, U.S.A., 2011, pp 573-780.
- 5) D. Batista and P.M. Oliveira-Lemos, "Preparing and Administering Medications by Enteral Feeding Tubes: A Guideline for Clinical Pharmacists and Multi-Professional Team", *Revista Brasileira de Farmácia Hospitalar e Serviços de Saúde*, 2021, 12, 2, pp 600-622.
- 6) D. Kenny and P. Goodman, "Care of the Patient with Enteral Tube Feeding: An Evidence-Based Practice Protocol", *National Library of Medicine*, 2019, 59, 31, pp 1124-1130.
- 7) D. Sari, D. Kadifeli, A. Akbiyik and N. Taskiran, "Intensive Care Unit Nurses' Knowledge of Medication Administration by Enteral Tubes", *British Association of Critical Care Nurses*, 2018, 23, 3, pp 141-146.
- 8) D. Straub, M. Boudreau, and D. Gefen," Validation Guidelines for IS Positivist Research", *Communications of the Association for Information Systems*, 2004, 3, 1, pp 13-19.
- 9) F.A. Ahmed, O.A. Ahmed, E.A. Albitar and S.E. Ghoneim, "Effect of Educational Nursing Guidelines Regarding Enteral Feeding on Nurses' Knowledge and Practices at Critical Care Units", *Journal of Nursing and Health Science*, 2018, 7, 5, PP 69-75.
- 10) F.M. Attia, M.H. Mahmoud, and N.M. Abo El –Fadl, " Effect of Implementing Nursing Guidelines on Nurses' Performance Regarding Complications of Nasogastric Tube among Critically ill Patients", *Journal of Nursing Science*, Benha University, 2021, 2, 2, 586-600.

- 11) H.M. Alsamet, "Considerations regarding oral medications delivery to patients on nasoenteral tubes/Considérations concernant l'administration de médicaments par voie orale aux patients en nutrition entérale", *Nutrition Clinique et Métabolisme*, 2022, 36, 1, pp 21-27.
- 12) H. Tillott, D. Barrett, H. Morrissey, J. Ruan, V., Li, S. Merrick, H. Steed, and P.A. Ball, "Survey of nurses' knowledge and practice regarding medication administration using enteral tubes", *Journal of Clinical Nursing*, 2020, 29, pp 4614–4622.
- 13) J.I. Boullata, "Enteral Nutrition Tolerance in Critical Illness", *Nutrition in Clinical Practice*, 2020, 36, 1, pp 111-132.
- 14) M.Al Kalaldehy, and M. Shahin, "Implementing evidence-based enteral nutrition guidelines in intensive care units: a prospective observational study", *Gastrointestinal Nursing*, *Journal of American Science*, 2015, 13, 9, pp 31-39.
- 15) M. Linda, "Enteral Access Devices: Types, Function, Care, and Challenges", *Nutrition in Clinical Practice*, 2018, 33, 1, pp 16-38.
- 16) M. Salah, W. Yossef and M. Ismail, "Assessment of Nurses' Knowledge and Practices Administration of Medication by Enteral Tube", *Lap Lambert Academic Publishing*, 2014, 5, 4, pp 128–156.
- 17) M. Salem, J. Labib, A. Mahmoud and S. Shalaby, "Nurses' Perceptions of Patient Safety Culture in Intensive Care Units: A Cross-Sectional Study", *Journal of Medical Sciences*, 2019, 7, 21, pp 3667–3672.
- 18) M. Shahin, W. Mohamed, and M. Sayed "Nurses Knowledge and Practice Regarding Enteral Nutrition at the Critical Care Department of Al-Manial University Hospital in Egypt: impact of a designed instructional program", *Journal of American Science*, 2012, 8, 11, pp 397-405.
- 19) N. Abu Hdaib, A. Albsoul-Younes and M. Wazaify, "Oral Medications Administration Through Enteral Feeding Tube: Clinical Pharmacist-Led Educational Intervention to Improve Knowledge of Intensive Care Units' Nurses at Jordan University Hospital", *Saudi Pharm Journal*, 2021, 29, 2, pp 134–142.
- 20) R.F. Craven, C.J. Hirnle and C.M. Henshaw, "Medication Administration, Fundamental of Nursing Concepts and Competencies for practice", 9th ed, *Wolters Kluwer Health, Lippincott Williams and Wilkins*, U.S.A., 2021, pp 495-499.
- 21) R. Pereira., F. Souza, M. Rigobello, J. Pereira, L. Costa and F. Gimenes, "Quality Improvement Program Reduces Errors in Oral Medication Preparation and Administration through Feeding Tubes", *BMJ Open Quality*, 2020, 9, 1, pp 44-47.
- 22) S. Luokkamäki, M. Härkänen, S. Saano, and K. Vehviläinen-Julkunen, "Registered Nurses' medication administration skills: a systematic review", *Scandabyn Journal of Caring Science*, 2021, 35, 1, pp 37–54.
- 23) S. Roberts, R. Brody, S.H. Rawal, and L. Byham-Gray, "Volume-Based vs Rate-Based Enteral Nutrition in the Intensive Care Unit: Impact on Nutrition Delivery and Glycemic Control", *Journal of Parenteral and Enteral Nutrition*, 2019, 43, 3, pp 365-375.
- 24) S.A. Taher, M. Zolfaghari, Ch. Cho, M. Abedi, and M. Shahidehpour, "A New Approach for Soft Synchronization of Microgrid Using Robust Control Theory, institute of electric and electronic engineering", 2016, 32, 3, pp 1370 – 1381.
- 25) S.H. Alhashemi, R. Ghorbani and A. Vazin, "Improving Knowledge, Attitudes, and Practice of Nurses in Medication Administration through Enteral Feeding Tubes by Clinical Pharmacists: A Case–Control Study", *Advances in Medical Education and Practice*, 2019, 10, pp 493–500.

- 26) SH.I. Abd Elgwad, K.F. Abdallah and B. Khalil, "Effect of Medication Safety Guidelines on Prevention of Medication Errors among Nurses in the Intensive Care Unit, Egyptian", *Journal of Health Care*, 2022, 13, 3, pp 301: 313.
- 27) S.C. Bischoff, P. Austin, K. Boeykens, M. Chourdakis, C.Cuerda, Jonkers- C. Schuitema, M. Lichota, I. Nyulasi, S.M. Schneider, Z. Stanga, and L. Pironi, " ESPEN guideline on home enteral nutrition, *clinical nutrition journal*, 2020, 39, 1, pp 5-22.
- 28) S. R. Mohammed, S. M. Attia and H. A. Abdelrahman, "Assessment of Nurses' Knowledge and Practices about Medications Administration by Nasogastric Tube at Emergency Hospital", *Mansoura Nursing Journal (MNJ)*, 2020, 7,1, pp 1-18.
- 29) Y. Chen, M. Michalak, and L.B. Agellon, "Importance of Nutrients and Nutrient Metabolim on Human Health", *National library of medicine*, 2018, 91, 2, 95–103.