

Nurses' Knowledge and Practices regarding Enteral Nutrition at the Critical Care Department of Al- Manial University Hospital in Egypt: Impact of a Designed Instructional Program.

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Abstract: Patients in the critical care setting are at high risk of malnutrition due to the nature of their illness, stressors and their hyper-metabolic state. Enteral nutrition is the preferred route of nutrient administration in critically ill patient. Compared with total parenteral nutrition; the enteral route is safer, more physiologic and less expensive. As the nursing role in tube insertion, enteral feeding delivery and care is crucial, the nurses' knowledge and practice regarding enteral nutrition will affect the patient clinical outcomes. The **aim of this study** was to examine the impact of a designed instructional program on the nurses' knowledge and practices regarding enteral nutrition in the critical care department of Al-Manial University Hospital. A quasi-experimental (time series) **design** was used in the current study. A convenient sample of **85 nurses** representing approximately all practitioner nurses at **the critical care department at Al-Manial University Hospital**. Data were obtained through three main **tools**; knowledge assessment questionnaire with the socio-demographic data sheet, observational checklist and session evaluation form. The instructional program was designed based on an extensive revision of the related materials, recent medical textbooks, studies and literature. **Method**; The instructional program was conducted over 21 repeated lectures during different working shifts in an average of 6 sessions per week for one month, 90 minutes each.; lectures included watching some educational videos for the practical skills related to enteral nutrition. **Results** revealed that the designed instructional program was having an effective, sustainable impact on improving nurses' knowledge and practice regarding enteral nutrition in the critical care department. **The study concluded** that nurses had lack of knowledge and some unsafe practices regarding enteral feeding in the critical care department, however, the instructional program showed a positive impact in improving nurses' knowledge and practice regarding enteral nutrition in the critical care department. **The study recommended** establishing a written updated protocol of enteral nutrition to ensure enough knowledge, unified and safe nursing practice; it's recommended to implement this study on other hospitals in Cairo and Egypt. Moreover, the implementation of continuous education programs regarding enteral nutrition can play a part in supporting clinical practice.

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1. Introduction

The gastrointestinal tract plays an important role in maintaining body immunological defenses, it improves gut and liver functions, reduces infection rate and promotes better survival rate in critical care units. Tube feeding is used for a patient who has at least some digestive capability but is unwilling or unable to consume enough food by mouth. Nutritional support has become a routine part of the care of the critically ill patient. Feeding the critically ill patient is a unique challenge in nutritional management. Nutritional support should be started as soon as possible after admission and should be maintained as long as the patient does not eat adequately as prolonged starvation increases the risk of morbidity and mortality.

Enteral nutrition is the preferred route of nutrient administration in the critically ill patient. It

maintains the integrity of the gut mucosa and has immunologic advantages over parenteral nutrition. Compared with total parenteral nutrition; the enteral route is safer, more physiologic and less expensive (ESPEN, 2009).

Patients in the critical care setting are at high risk of malnutrition, due to the nature of their illness and their hyper-metabolic state. Their immune system is compromised, so they are at increased risk of infection and septicemia. Delayed healing and infections contribute to prolonged intensive care stay, increased mortality and morbidity and higher treatment costs. Therefore, Correct nutrition from the onset of admission is imperative (Blackburn et al., 2010).

The nurse roles in delivering the tube feeding usually include insertion of the feeding tube; if temporary tube is used; maintenance of the tube,

administration of feeding, prevention and detection of complications associated with this form of therapy and participation in assessment of the patient's response to tube feeding (Urden et al., 2006). However, in more advanced critical care units, the RNs calculate patient's needs of calories, body's requirements, analyze daily calories delivery and advocate for early enteral feeding (Engel *et al.*, 2003).

Many studies identified a low caloric intake when enteral nutrition is administered to intensive care patients (Williams & Leslie, 2004). Moreover, many observed complications related to tube feeding have been documented in clinical practice, such as pulmonary aspiration, diarrhea, constipation, tube occlusion, and delayed gastric emptying (Urden et al., 2006). Thus, the aim of this study was to examine the impact of the designed instructional program on the nurses' knowledge and practices regarding enteral nutrition in the critical care department at Al-Manial University Hospital.

Significance of the study

As a critical care nurse, the researcher noticed some nursing noncompliance with the enteral feeding instructions and protocols regarding enteral nutrition; such as tube verification, amount and frequency of enteral feeding, drugs crushing, medications mixing and many other observations. At the same time, little is known about the nurses' knowledge regarding enteral nutrition in the critical care units; moreover, few studies handled the daily nursing practices regarding enteral nutrition and medications administration through feeding tubes in critical care settings, especially in Egypt.

As the basic knowledge and nursing activities regarding enteral feeding can differ from health care institution to another and even within the same institution; therefore, special studies should be carried out to explore nurses' knowledge and identify their practices regarding enteral nutrition in order to determine the gaps, defects and work necessary to overcome the defects by constructing and applying a well-designed instructional program based on the identified needs and observations to enrich nurses' knowledge and improve their practices regarding enteral feeding of critically ill patients.

As each nurse is dealing with many patients, Nurses' education will have great effect and will be reflected on high number of patients and certainly will be more beneficial than patient centered education. The improvement of nurses' knowledge and practices regarding enteral nutrition will directly or indirectly lead to reduce the complications and side effects related to enteral feeding in the critical care units.

Aim of the study

The aim of the study has four folds: 1-To assess the nurses' knowledge and practices regarding enteral nutrition in critical care department. 2-To design a comprehensive instructional program about enteral nutrition based on the nurses' educational needs. 3-To implement the instructional program on the target nurses. 4-To evaluate the effectiveness of the instructional program on the nurses' knowledge and practices regarding enteral nutrition in the critical care department at Al-Manial University hospital.

Research Questions

What do the nurses know about enteral nutrition in the critical care department? What are the current nurses practices regarding enteral nutrition in the critical care department?

Research Hypotheses:

Nurses who attend the instructional program will have a higher mean post- test scores related to knowledge of enteral nutrition compared to mean pre-test scores. Nurses who attend the instructional program will have a higher mean post- test scores related to practices of enteral nutrition compared to mean pre-test scores.

Theoretical Framework:

The nursing process theory was adopted as a theoretical framework for the current study. This theory, which was developed by Ida Jean Orlando in the late 1950's, consists basically of five steps: Assessment, Diagnosis, Planning, Implementation and Evaluation.

2. Subjects and Methods

Study design:

A quasi-experimental (time series) design was used in the current study where the nurses' sample served as their own control (Single group study).

Sample:

A convenient sample of 85 male and female nurses with different educational level representing approximately all practitioner nurses working at the critical care department at Al-Manial University Hospital and willing to participate voluntarily in the study.

Setting of the study:

This study was conducted in the critical care department at Al-Manial University Hospital. This department is composed of two main units (Sherif Mokhtar and Hossam Mowafy Units) which contain many critical care units with a large number of nurses working there.

Procedure:

The study was conducted on 4 phases (preparatory phase, implementation phase, evaluation phase and dissemination phase).

1-The preparatory phase:

The researcher reviewed the related materials, recent medical textbooks and literature extensively.

He searched the relevant studies on regional and global levels and searching process included libraries of local universities, regional and global electronic web sites, like Pubmed, Cochrane, Medscape, Medline and others; then, constructed and tested the tools and the instructional program of the study. The three study tools are:

Knowledge assessment questionnaire: to assess the nurses' knowledge related to enteral nutrition before and after conducting the instructional program. It was also used to collect data related to socio-demographic variables of the participants.

The observational checklist: to assess the nurses' practices regarding enteral nutrition.

Session evaluation form: to give the participants opportunity to express their feelings and opinions about the instructional program provided.

First: Knowledge assessment questionnaire:

The questionnaire was consisting of 45 questions related to enteral feeding from different aspects, as follows:

1-	Definitions of the enteral nutrition	3 questions
2-	Indications and uses of enteral nutrition	3 questions
3-	Contraindication of enteral nutrition	3 questions
4-	Insertion of enteral feeding tubes	5 questions
5-	Enteral feeding	8 questions
6-	Formulas' handling	3 questions
7-	Medications' administration	7 questions
8-	Care of enteral nutrition	9 questions
9-	Complications of enteral nutrition	4 questions
	Total	45 question

Second: The observational checklist:

It was consisting of three main checklists; 1- the insertion of Nasogastric tube, 2- the administration of medications through the enteral feeding tubes 3- the enteral feeding administration checklist. Items of each checklist as follows:

1-	Insertion of Nasogastric tube	22 items
2-	Administration of medications	21 items
3.	Enteral feeding administration	26 items
	Total	69 items

Tools Validity:

Content validity, for both knowledge assessment questionnaire and the observational checklist, was checked by a panel of 4 experts specialized in medical surgical nursing, critical care nursing, critical care medicine and clinical nutritional. The necessary modifications were done.

Reliability of the tools:

The reliability of the knowledge assessment questionnaires and the observational checklist was measured using Cronbach's alpha test and the values of Cronbach's alpha were (0.932) and (0.891) respectively.

Scoring system of the tools:

Regarding knowledge assessment questionnaire, the correct and incorrect answers were scored 1 and 0 respectively. Some of the multiple choice questions were having more than one correct answer and were scored 1 on each correct answer chosen.

Accordingly, the overall score of the questionnaire ranging from (0-92) degrees with a cut-score at 65%.

-Adequate knowledge ranged from (60 - 92) degrees.

-Inadequate knowledge (0-59) degrees.

The observational checklist was scored in the form of (Done =2 degrees, Not done = 1 and N/A=0).

Accordingly, the overall score of the observational checklist ranging from (0-138) degrees with a cut score at 70%.

-Adequate skills ranged from (97 - 138) degrees.

-Inadequate skills (<96) degrees.

Third: Session's evaluation form:

The form consisted of (13) items about the effectiveness of the provided instructional program materials. Scale was scored in the form of likert scale according to three levels, range from three degrees and one degree as follows:

-To large extent (3 degrees).

-To a medium degree (two degrees).

-To low extent (one degree).

The overall degree of scale range from (13- 39) degrees.

Pilot Study:

A pilot study was carried out on 10 nurses from the study subjects to test the clarity, applicability, feasibility & relevance of the tools used and to determine the needed time for the application of the study tools. Modifications on tools and program contents were done and the 10 nurses were excluded from the final study sample.

2-The implementation phase:

The first pre-test sheet was distributed to collect participants' socio-demographic data and to assess their knowledge regarding enteral nutrition using the questionnaires. At the same time and over many visits, the researcher was monitoring the nurses during their work to fill out the observational checklist.

The instructional program was conducted over 21 repeated lectures during different working shifts in an average of 6 sessions per week for one month; each lecture was taking about 1.5 hours. The instructional program included presentation and watching some educational videos for the practical skills related to enteral nutrition.

3-The Evaluation phase:

Each lecture was evaluated by the participants at its end separately, so the study group clarified their feelings and opinions toward the lecture provided and the performance in general using the evaluation form.

Post-test evaluation of nurses' knowledge and practice was conducted immediately after the instructional program using the questionnaire and observational checklist. Follow up data collection was conducted again after one month and two months from the conduction of the instructional program at the critical care department.

4-Dissemination phase:

After being discussed with the advisor, the results of the study were disseminated to the participants, nursing supervisors and the managers of the critical care department at Al-Manial university hospital with copies of the instructional program booklets.

Ethical consideration:

The present study was approved by the Scientific Research Ethics Committee of the faculty of nursing- Cairo University and the administration of the critical care department at Al-Manial university hospital. A written permission (informed consent) for participation was obtained from each participant at the first meeting after providing a complete description of the study. All ethical issues of research were maintained.

Statistical Analysis:

Data were analyzed using statistical package for social sciences (SPSS) version 20. Descriptive statistics, Correlation coefficient, Mann Whitney test and One Way ANOVA tests were used in the analysis. A significance level was considered at $P = 0.05$.

3. Results

Findings of the present study revealed that three quarters of the study sample were female, 37.6% were less than 25 years old compared to 34.1% were between 25 and 34 years and the rest were more than 34 years old, nearly quarter of the studied sample had less than one year experience and the same proportion had experience of 15 to 19 years. 83.5% did not attend nutritional courses before, 60% were diploma degree holders and 49.4% were single compared to 43.5% were married.

As mentioned previously, the nurses were considered as having adequate knowledge if they scored at least 60 degrees out of 92 in the knowledge assessment questionnaire. Based on that, 15 nurses only out of 85 had adequate knowledge in pre-test results. On the other hand, nurses were considered as competent in enteral feeding practice if they scored at least 97 degrees out of 138. In accordance with that,

50 nurses out of 85 were competent in enteral feeding practice before program implementation.

Table (1) and (2) show that; the baselines mean scores for total & subtotal knowledge and practice regarding enteral nutrition were low before the instructional program application. However, a sharp increment in the mean knowledge and practice scores was observed immediately after the implementation of the instructional program with significant statistical difference in mean scores of the knowledge and practice during the four assessments stages.

By the use of Scheffe post test matrix to identify the direction of differences in total and subtotal knowledge and practice scores, the results revealed that the statistical significant difference and improvement was observed in the total and subtotal knowledge and practice scores between pre and post-program assessment; so the research hypotheses were supported. Results of 1 month and 2 months follow up evaluation revealed that this increase was sustainable and lasted two months later with p -value of 0.01.

As regards to the relationship between socio-demographic variables and the nurses' knowledge and practice regarding enteral nutrition, findings of the present study revealed no statistical significant difference between males and females in pre-test knowledge and practice. On the other hand, there was a highly statistical significant difference between male and female nurses in the total knowledge and practice about enteral feeding post-test, 1 month and 2 months following the instructional program as male nurses scored higher than the female nurses.

Regarding the age of the participants, negative statistically significant correlation detected between the participants' age and their total scores of knowledge in the evaluation of post-test, 1 month and two months following the instructional program. The results reflected also highly negative statistically significant correlation at ($P < 0.01$) between the participants' years of experience and scores of knowledge and practice regarding enteral feeding in the evaluation of pre-program, post-program, 1 month and 2 months following the instructional program.

There was a highly statistical significant difference in the mean total knowledge and practice regarding enteral feeding among pre-test, post-test, 1 month and 2 months following the instructional program in relation to the educational levels. Bachelor degree nurses scored significantly higher than the diploma degree nurses in knowledge and practice.

There was a statistical significant difference in pre-test knowledge scores between the participants who attended previous educational sessions regarding enteral nutrition and others who did not. However,

nurses who attended previous educational sessions scored significantly higher than the others in pre-test knowledge. This difference was not statistically significant in post-test, 1 month and 2 months follow up scores.

A highly positive statistical significant correlation at ($P < 0.01$) was found between the total

knowledge scores of the participants and the total practice scores in pre-program, post program, 1 month and 2 months following the instructional program (Table 3). No other significant correlation was detected in the results analysis.

Table (1): Total and subtotal Mean knowledge scores regarding enteral nutrition in pre-test, post-test, 1 month and 2 months following up (n=85).

Items	Pre-test	Post-test	Follow 1 month	Follow 2 month	F Test	P Value
	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD		
Definition of EN	2.98 \pm 1.38	5.1810 \pm 1.20720	4.9846 \pm 1.21825	5.0706 \pm 1.19312	60.415	** < 0.0001
Indication & uses	5.57 \pm 2.52	7.6857 \pm 1.77219	7.4769 \pm 1.84651	7.5765 \pm 1.78870	21.716	** < 0.0001
Contraindications	3.57 \pm 2.28	6.209 \pm 1.752	6.523 \pm 1.621	6.294 \pm 1.737	45.925	** < 0.0001
Insertion of NGT	1.81 \pm 0.89	4.000 \pm 1.407	4.030 \pm 1.510	3.988 \pm 1.443	57.785	** < 0.0001
Enteral Feeding	6.67 \pm 2.44	9.466 \pm 1.687	9.261 \pm 1.830	9.341 \pm 1.756	41.186	** < 0.0001
Formulas' handling	1.84 \pm 0.87	2.685 \pm 0.486	2.661 \pm 0.508	2.658 \pm 0.524	37.486	** < 0.0001
Medication admin	2.80 \pm 1.24	6.342 \pm 1.555	6.353 \pm 1.671	6.317 \pm 1.627	114.17	** < 0.0001
Care of EN	11.83 \pm 3.97	17.390 \pm 2.77	17.153 \pm 2.916	17.223 \pm 2.804	63.523	** < 0.0001
Complications	8.58 \pm 4.66	13.828 \pm 1.778	13.938 \pm 1.757	13.823 \pm 1.774	75.570	** < 0.0001
Total knowledge	45.694 \pm 13.050	72.790 \pm 8.094	72.384 \pm 8.182	72.294 \pm 8.190	165.597	** < 0.0001

Table (2) :Total and subtotal Mean practice scores regarding enteral nutrition in pre-test, post-test, 1 month and 2 months following up (n=85).

Items	Pre-program	Post-program	Follow 1 month	Follow 2 month	F Test	P Value
	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD		
NGT Insertion	32.411 \pm 5.538	38.523 \pm 4.908	38.723 \pm 4.938	38.541 \pm 4.926	31.313	** < 0.0001
Medications Administration	32.411 \pm 5.538	37.676 \pm 4.810	37.492 \pm 4.700	37.552 \pm 4.782	23.019	** < 0.0001
Enteral Feeding	39.270 \pm 6.416	45.952 \pm 5.122	45.876 \pm 4.910	45.823 \pm 5.017	31.789	** < 0.0001
Total practice	103.635 \pm 16.574	122.152 \pm 13.963	122.092 \pm 13.309	121.917 \pm 13.687	34.416	** < 0.0001

Table (3) Correlation between the nurses' knowledge and practice in the pre-test, post-test, 1 month and 2 months follow up (n=85).

Items	Pre-program	Post-program	1 month follow	2 months follow
Knowledge scores	r = 0.928	r=0.847	r=0.846	r=0.843
Practice scores	$P^{**} < 0.0001$	$P^{**} < 0.0001$	$P^{**} < 0.0001$	$P^{**} < 0.0001$

4. Discussion

From the analysis of the 45 items knowledge assessment questionnaire, the pre-test results revealed that knowledge about indications and uses of enteral nutrition occupied the first rank with the highest percentage weight, formulas' handling occupied the second rank; care of EN occupied the third rank, the complications of EN occupied the fourth. Enteral feeding administration occupied the fifth rank, the definition of EN occupied the sixth, contraindications of EN occupied the seventh, and medications' administration occupied the eighth, while the last rank was occupied by the knowledge about Nasogastric tube insertion. The mean score of the total knowledge about enteral nutrition before instructional program was 45.7/92 degrees. This reveals that the nurses' knowledge about enteral nutrition in the critical care department was low and inadequate.

The results were consistent with a study of Al-Kalaldeh (2011) who assessed 253 critical care nurses from three major hospitals in Jordan; the results revealed that around 70% of the participants' scored less than 60% in knowledge comprehension regarding enteral nutrition. Similarly, in a study

aimed to evaluate the effectiveness of an educational program about enteral nutrition on 55 critical care nurses using pre-post test (Bourgault *et al.*, 2007); although the results predicted an increase in nurses' knowledge after the educational program; however, the researcher mentioned that the scores of the tests taken before the program were lower than he had anticipated.

Through the discussion that occurred during the implementation of the instructional programs, the participants declared that the main reason behind the lack of knowledge about enteral nutrition was the lack of hospital policies and protocols regarding enteral

nutrition management in the critical care department. Lack of training programs, work overload at unit, as well as, limited knowledge related to the use of internet were a participant causes in the shortage of knowledge.

In this analogy, Mona Persenius (2008) mentioned in her study, which reflected relatively acceptable pre-test nurses' knowledge score about EN, that the majority of nurses from 3 hospitals in Sweden indicated that there were written guidelines regarding EN in their ICUs. On the other hand, Mota (2010) in Brazil related the shortage of nurses' knowledge to the deficient in academic education which does not address items related to enteral feeding and medication administration techniques.

Regarding the nurses' practices and according to the pre-program scores; medications' administration through EN tubes occupied the highest rank; enteral feeding administration occupied the second rank while NGT insertion came last. The mean score of pre-program practice was 103.6 out of 138 degrees that reflected many incompetent and unsafe practices of nurses.

Nurses at the critical care department at Al-Manial university hospital had no available written protocols or resources of information to update their knowledge and improve their practices about enteral feeding, medications administration, drugs preparations, side effects, drug - drug and drug - food interactions. However, that may explain the level of nurses' knowledge and practices regarding enteral feeding.

Relatively similar results were reported by Al-Kalaldehy (2011) who concluded that the nursing practice regarding enteral nutrition is not enough and highly reflected on the improvement of the patients' nutritional status and health condition, as well as, the patients' safety and reported medications errors in the critical care units.

From the analysis of the mean scores of the participants' knowledge about enteral nutrition, the results revealed that the instructional program had a positive impact in the improvement of the nurses' knowledge about enteral nutrition and this improvement was sustainable after 1 and 2 months following the instructional program.

These findings were supported by study carried out in the USA and mimic this study; the aim was to implement an educational program about enteral nutrition on 55 critical care nurses from 5 different critical care units to evaluate its effectiveness, the results revealed significant increment in mean score of knowledge after program implementation (Bourgault *et al.*, 2007). In another study conducted by Khalifa (2007) showed that nurses had lower level of evidence-based knowledge in the management of fever in pre program phase than at the first follow-up. The results

reflected retention of nurses' evidence-based knowledge in the management of fever at second follow-up phase.

On the contrary, Tweed & Tweed (2008) study came with different results. Their study was conducted at hospital in New Zealand to assess intensive care nurses' knowledge of pressure ulcers and the impact of an educational program on knowledge levels. The knowledge assessed 3 times: before, within 2 weeks, and 20 weeks after the program. The results revealed minimal non-statistical significant improvement of knowledge with the educational program, but soon returned to baseline.

From the analysis of the mean score of the participants' practices regarding enteral nutrition, the results of the current study revealed that the instructional program had a positive impact in the improvement of the nursing practice regarding enteral nutrition and this improvement was sustainable after 1 and 2 months of the instructional program.

The improvement of nurses' practice as a result of implementing an educational or training program was well recognized and supported by many researches around the world. In study concerned with medications' administration via enteral feeding tubes, Kenny & Goodman (2010) pointed out that there was improvement in all practices of enteral feeding and medications administration after the conduction of the program.

In accordance with that, Helder *et al.* (2010) conducted study to evaluate the impact of an educational program on hand hygiene compliance in Sophia children's hospital in Nederland, hand hygiene compliance increased significantly for nurses and the infection rate decreased significantly before and after the educational program on hand hygiene.

In another study conducted by El-Dakhakhny (2011) in 3 maternal and child health units at El-Zagazig city in Egypt, the study aimed to evaluate the impact of educational program on nurses' knowledge and practices regarding congenital hypothyroidism. It was found that total scores of the nurses' knowledge and practice improved significantly at post-test. In line with this perspective, recent study was conducted by Abdalrahim (2009) to evaluate the effect of an educational program on Jordanian nurses' practice, knowledge, and attitudes. The results revealed great improvement of the nurses' knowledge and practice regarding pain assessment and the improvement maintained after 12 weeks of the implementation of the pain management educational program.

Regarding the gender of the participants, the results of the study declared that 75.3% of the study sample was female nurses. This high proportion of female nurses is most probably attributes to the fact that the study of BSN in the Egyptian universities was

exclusive for females only till few years ago, so the profession of nursing in Egypt was mostly feminine.

The present study revealed no statistical significant difference between males and females in pre-test knowledge and practice. On the other hand, there was a highly statistical significant difference between male and female nurses in the total knowledge and practice about enteral feeding post-test, 1 month and 2 months following the instructional program and the male nurses scored higher than the female nurses. This might attribute to the fact that the majority of the male nurses are young and new graduates which make them flexible, cooperative and more receptive with better tolerance and memory abilities.

This result disagree with the results of Al-Kalaldehy (2011) study which was conducted on nurses from 3 hospitals in Jordan, no significant difference was found between male and female nurses regarding their knowledge, practice or nursing documentation of enteral nutrition.

Regarding the age of participants, the results revealed that 37.6% of the nurses were young (less than 25 years) compared to 34.1% were between 25 and 34 years and the rest were >34 years old. Negative statistically significant correlation was detected between the participants' age and their total scores of knowledge in post-test, 1 month and two months following the instructional program. At the same time, the results reflected non-statistically significant correlation between the participants' age and scores of practice regarding enteral feeding in pre-program, post-program, 1 month and 2 months following the instructional program.

This negative correlation between age and the participants' knowledge scores is related, as mentioned before, to the fact that the young participants are new graduates, flexible, cooperative and more receptive with higher education, better tolerance and memory abilities.

The results contradicted with recent study carried out at Mansoura University hospital, the analysis of the results detected a positive statistically significant correlation between post program knowledge score and age of participants; but the results agree with the current study as there was no significant statistical differences between practice score and age of participants (Mohamed & Wafa, 2011). In another contrary study from USA, Kimberly Penland (2010) reported no significant correlations between the nurses' knowledge about nutrition and their age in a study aimed to assess the relationship between nurse nutritional knowledge and their practices in preventing unintentional weight loss in nursing home residents.

In regard to the years of experience, the results of the current study mentioned that nearly one quarter of the studied sample had less than one year

experience (internship) and the same proportion of the studied nurses had experience of 15 to 19 years. The results reflected also highly negative statistically significant correlation between the participants' years of experience and scores of knowledge and practice regarding enteral feeding in pre-program, post-program, 1 month and 2 months following the instructional program.

This inverse correlation between years of experience and participants' knowledge scores is related to the positive directional correlation between the years of experience and the participant age; however, young participants were new graduates, flexible, cooperative and more receptive with higher education, better tolerance and memory abilities. At the same time, factors like work overload, lack of continuous educational program about enteral nutrition in the clinical setting and the lack of enthusiasm of the staff to enrich their knowledge enhanced time to serve as helping factor for more forgetfulness and loss of knowledge. In the same vein, more experience period of the participants reflected less practice scores regarding enteral feeding, medications administration and tubes insertion as the practices are not dependent on evidence based practices or updated references.

The results were incongruent with Mohamed & Wafa study which was carried out at Mansoura University Hospital (2011) and found positive statistically correlation between practice and year of experience. The findings were also inconsistent with an Indian study conducted by Suchitra and Lakshmi (2007). The study aimed to evaluate the impact of education on knowledge, attitudes and practices regarding nosocomial infections among various categories of health care workers. The results reported that years of experience in the hospital significantly correlated to increased knowledge, attitudes and practices among the various categories of staff.

Regarding the participants' educational level, the results indicated that more than half of the studied nurses were diploma degree holders compared to 40% of them were bachelor degree holders. As the setting of the study is a governmental hospital, the retention of staff is high and the turnover is low. Nursing staff who was working in the critical care department at Al-Manial university hospital were mainly diploma degree holders as the bachelor of nursing university study had started recently to feed the hospitals with BSN holders. Most of the BSN holders in the unit were internship students. After the internship training, they prefer working in the private sector or in the gulf region for financial reasons.

The current study revealed a highly statistical significant difference in the scores of total knowledge and practice regarding enteral feeding among pre-test, post-test, 1 month and 2 months following the

instructional program in relation to the educational levels. Bachelor degree nurses scored significantly higher in the knowledge and practice scores compared to diploma degree nurses in pre-test, post-test, 1 month and 2 months following the instructional program

Many studies were supporting the above mentioned results. In a study done by Penland (2010) in the USA to assess the relationship between nurses' nutritional knowledge and their practices in preventing unintentional weight loss in nursing home residents; level of nurse education was positively correlated with nurses' knowledge scores about nutrition.

In another study done by Mohamed & Wafa (2011) at Mansoura University Hospital, the results illustrated that there was statistically significant correlation between knowledge, practice and educational level of the participants. Besides, another study indicated that significantly higher levels of medication errors and procedural violations are committed by nurses prepared at the associate degree and diploma levels as compared with the bachelor level nurses (Tourangeau *et al.*, 2007).

Regarding the attendance of previous educational courses in enteral nutrition, there was statistical significant difference in pre-test total knowledge scores between the participants who attended previous educational sessions regarding enteral nutrition and others who did not. Pre-test scores of knowledge for the participants who attended previous educational sessions about enteral nutrition were significantly higher than that for the nurses who hadn't. On the other side of the coin, that difference was not statistically significant in post-test, 1 month and 2 months following the instructional program.

This difference in the pre-test scores of knowledge may attributes to the exposure to recent updated knowledge about enteral nutrition for the nurses who attended previous educational sessions about enteral nutrition. However, after attending our comprehensive educational program, no statistical significant difference was noticed in the knowledge scores between the two groups in post-test, 1 month and 2 months following. In the same context, the current study indicated no statistical significant difference of the total practice scores between the participants who attended previous educational sessions regarding enteral nutrition and others who did not in pre-program, post-program, 1 month and 2 months follow up.

Little studies were published in nursing that focus on the relation between the attendance of previous educational programs and participants' knowledge or practice.

Regarding the participants' marital status, the study mentioned that nearly half of the studied sample were single compared to 43.5% were married and 7%

were divorced and widowed. There was no statistical significant difference in the mean total knowledge or practice of enteral feeding among pre-program, post-program, 1 month and 2 months following the instructional program in relation to participants' marital status.

Regarding the participants' working units, The results revealed no statistical significant difference in mean total knowledge or practice between the nurses who work at Sherif Mokhtar unit and others who work at Hossam Mowafy unit in pre-test, post-test, 1 month and 2 months following the instructional program.

The current study results were consistent with a study done by Mohamed & Wafa (2011) at Mansoura University Hospital, the results found no significant statistically differences between practice score and place of work.

Regarding the correlation between the participants' knowledge and practice, the current study presented a highly statistical significant correlation between participants' scores of knowledge and practice in pre-program, post program, 1 month and 2 months following the instructional program. This strong correlation between nurses' knowledge and practice is highly expectable; however, the effective establishment of enteral feeding is often hindered by lack of knowledge, basic knowledge about enteral feeding is essential for nursing practice.

This result was congruent with a recent study which was about "the development of evidence-based guidelines and critical care nurses' knowledge of enteral feeding". The study found that several enteral nutrition practices are directly influenced by nurses, and that practices suggests that nurses' knowledge related to enteral nutrition is essential to achieve the best practice and optimal outcomes for patients (Bourgault *et al.*, 2007).

5. Conclusion:

The nurses' knowledge and practices regarding enteral nutrition at the critical care department were not enough with some unsafe practices. There was a lack of educational materials, policies and protocol about enteral nutrition in the critical care department. The instructional program had a positive effect in improving the nurses' knowledge and practices regarding enteral nutrition in the critical care department at Al-Manial University hospital.

Recommendations:

It is recommended to establish a written updated protocol of enteral nutrition to ensure enough knowledge, unified and safe nursing practice; it's also recommended to implement this study on other hospitals in Cairo and Egypt.

An education program based on evidence related to enteral nutrition is of utmost importance for critical care nurses due to the shortage of new evidence-based knowledge and practices and the work overload on the nursing staff most of the time. Nurse continuous education programs about enteral nutrition can play a part too in supporting clinical practice by placing a strong emphasis on theoretical concepts, skill development and the use of critical appraisal skills.

Enhancing collaboration between health care providers and offering appropriate counseling should also be emphasized because the quality and safety in relation to nutritional nursing care is dependent on the interactions between the nurse and patient, between the nurse and the team, and the nurse and the organization.

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