Effectiveness of an Interventional Program on Nurses' Practice toward Total Parenteral Nutrition in Critical Care Units

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Abstract: ***Background***: Total Parenteral Nutrition provides intravenous nutrition for patients who are unable or cannot tolerate enteral nutrition, such as patients with intestinal failure, paralytic ileus, bowel ischemia, etc. It has been more than half a century since parenteral nutrition was first introduced. ***Objectives***: To evaluate nurses' practice toward parenteral nutrition in critical care units. To determine the effectiveness of an interventional program on nurses' knowledge toward parenteral nutrition in critical care units. To find out the relationship between nurses' practice and their demographic data. ***Methods***: A quasi experimental design study was used. Purposive sampling technique was employed, including 110 nurses recruited from 3 intensive care units in Baghdad city, Iraq. The study was conducted from July 1st 2023 to January 28th, 2024. A universal Scale was used to assess nurses' practice after the researcher permission which was consisted of three parts, the first part: written and oral informed consent, the second part: Socio-Demographic Data Sheet, third part: questionnaire to assess nurses' practice about parenteral nutrition, Observational checklist about nurses' practice toward TPN administration Consist of Three observations and divided into Fourth parts (Equipment's, Preparation, Performance, Evaluation), the tool designed as (applied {correctly, not correctly} & not applied) ***Results***: The findings reveals that nurses in the study group are showing low level of practice during the pre-test time (M ±SD = 20.85 ±4.56) while they are showing high level of practice during the post-test1 (M ±SD = 61.25 ±7.82) and post-test2 (M ±SD = 62.57 ±7.91) that indicate the clear changes in nurses' practice after applying interventional program. The nurses in the control group are showing low level of practice during the three times of test: pre-test (M ±SD= 19.7 ±4.43), post-test1 (M ±SD = 19.35 ±4.39), and post-test2 (M ±SD = 18.87 ±4.34) that indicate no clear changes in nurses 'practice. The collected data was analyzed using SPSS version 26. ***Conclusion***: This study concluded that there was positive affect of

interventional program in the improvement of the nursing staffs' practice toward parenteral nutrition in critical care units. There were no significant relationships between nurses' practice and their demographic characteristics.

Key Words: Effectiveness, Educational Program, Nurses' Practice, Total Parenteral Nutrition, Critical Care Units.

الخلاصة:

الخلفية: التغذية الوريدية الشاملة توفر التغذية الوريدية للمرضى غير القادرين على تحمل التغذية المعوية، مثل المرضى الذين يعانون من الفشل المعوي، والعلوص الشللي، ونقص تروية الأمعاء، وما إلى ذلك. لقد مر أكثر من نصف قرن منذ تقديم التغذية الوريدية لأول مرة. **الأهداف:** تقييم ممارسات الممرضين تجاه التغذية الوريدية في وحدات الرعاية الحرجة. تحديد مدى فعالية البرنامج التداخلي على معارف الممرضين تجاه التغذية الوريدية في وحدات الرعاية الحرجة. لمعرفة العلاقة بين ممارسة الممرضين وبياناتهم الديموغرافية. **المنهجية:** تم استخدام دراسة تصميمية شبه تجريبية. تم استخدام تقنية أخذ العينات الهادفة، بما في ذلك ١١٠ ممرضًا تم تعيينهم من ٣ وحدات للعناية المركزة في مدينة بغداد، العراق. أجريت الدراسة في الفترة من ١ يوليو ٢٠٢٣ إلى ٢٨ يناير ٢٠٢٤. تم استخدام مقياس عالمي لتقييم ممارسة الممرضين بعد إذن الباحث والذي يتكون من ثلاثة أجزاء، الجزء الأول: الموافقة الخطية والشفوية المستنيرة، الجزء الثاني: ا - ورقة البيانات الديموغرافية، الجزء الثالث: استبيان لتقييم ممارسة الممرضين حول التغذية الوريدية، قائمة المراجعة الرصدية حول ممارسة الممرضين تجاه إدارة TPN تتكون من ثلاث مشاهدات ومقسمة إلى أجزاء رابعة (المعدات، الإعداد، الأداء، التقييم)، الأداة مصممة كأداة (مطبق {صحيح، غير صحيح} وغير مطبق) **النتائج:** أظهرت النتائج أن الممرضين في مجموعة الدراسة يظهرن مستوى منخفض من الممارسة خلال فترة الاختبار القبلي (M ±4.56 ±SD = 20.85) في حين يظهرن مستوى مرتفع من الممارسة خلال الاختبار البعدي ١ (M ±SD = 61.25 ٧,٨٢± M ±SD = 62.57 ±7.91) والاختبار البعدي ٢ التي تشير إلى التغييرات الواضحة في ممارسة الممرضات بعد تطبيق البرنامج التداخلي. يظهر الممرضين في المجموعة الضابطة مستوى منخفض من الممارسة خلال ثلاث مرات من الاختبار: الاختبار القبلي (±SD M= ١٩,٧ ±٤,٤٣)، والاختبار البعدي ١ (M ±SD = 19.35 ±4.39)، والاختبار البعدي ٢ (M ±SD= 4.34± 18.87) والتي تشير إلى عدم وجود تغييرات واضحة في ممارسة الممرضين. تم تحليل البيانات التي تم جمعها باستخدام برنامج SPSS الإصدار ٢٦. **الاستنتاج:** خلصت هذه الدراسة إلى أن هناك تأثير إيجابي للبرنامج التداخلي في تحسين ممارسة طاقم التمريض تجاه التغذية الوريدية في وحدات الرعاية الحرجة. لم تكن هناك علاقات ذات دلالة إحصائية بين ممارسة الممرضين وخصائصهم الديموغرافية.

Introduction:

Nutrition is the intake of all growth and regeneration nutrients to maintain appropriate tissue and organ function. Malnutrition can have far reaching effects, including but not

limited to growth retardation, delayed wound healing, and immunological suppression, loss of skeletal muscle mass, atrophy of the intestinal mucosa, expansive edema, and impairment in cognitive capacities. Hospitalization, sickness, and mortality rates have all been on the rise, and malnutrition is a major factor. [1]

Nutritional therapy is an important part of treating critically ill patients because it allows the administration of energy and nutrients and reduces the incidence of malnutrition. In addition, nutritional therapy plays an essential role in pathophysiological changes and clinical outcomes of disease. [2]

Critical illness that necessitates crucial organ support is usually linked with an acute inflammatory response and necessitates bed rest, both of which promote lean body mass catabolism. These changes raise the risk of malnutrition or aggravate pre-existing malnutrition, resulting in increased morbidity and death [3]

Critically ill patients rely on artificial nutrition to maintain metabolic functioning and to avoid underfeeding caused by complications. As with hydration and pain control, providing proper levels of nutrients and energy should be a primary concern of the intensivist. This supply of basal care involves giving the patient a FAST HUG (feeding, analgesia, sedation, thromboembolic prophylaxis, head-of-bed elevation, stress ulcer prophylaxis, and glycemic control [4]

Parenteral nutrition (PN) is a life-saving intervention for patients where oral or enteral nutrition (EN) cannot be achieved or is not acceptable. The essential components of PN are carbohydrates, lipids, amino acids, vitamins, trace elements, electrolytes and water. PN should be provided via a central line because of its hypertonicity. However, peripheral PN (with lower nutrient content and larger volume) can be administered via an appropriate non-central line. There are alternatives for the compounding process also, including hospital pharmacy compounded bags and commercial multichamber bags. Several factors should be considered when providing PN, including timing of initiation, clinical status, and risk of complications. Parenteral nutrition (PN) can only be administered via venous access, which may be achieved through the use of peripheral or central venous catheters. [5,6]

Total parenteral nutrition administration is through a central venous catheter. A central venous catheter is an access device that terminates in the superior vena cava or the right atrium and is used to administer nutrition, medication, chemotherapy, etc. Establishing this access could be through a peripheral inserted central catheter (PICC), central venous catheter, or an implanted port. [7]

Clinicians can insert a PICC line into the basilic, cephalic, brachial, or median cubital vein. The basilic vein is preferable due to its larger size and superficial location. The catheter courses through the basilic into the axillary vein, to the subclavian vein, to settle in the superior vena cava. PICC lines could be used when TPN is administered for several weeks to months. [8]

Nurses play an important part in the treatment of total parenteral nutrition TPN patients, which involves maintaining the catheter and delivery system, preparing and giving TPN solutions, changing dressings at the catheter insertion site, and replacing the infusion set on a regular basis. Nursing personnel who care for patients in a critical care unit who are receiving TPN must be knowledgeable with its nutritional delivery. [9]

The indications for the use of TPN, as well as the potential dangers and issues connected with its administration, are something that registered nurses need to be familiar with. Essential skills for nurses include the capability of performing accurate calculations and mixing of TPN solutions, as well as vigilant monitoring for symptoms of adverse reactions or problems. [10]

The critically ill patients frequently suffer long-term physical and psychological complications. For patients mechanically ventilated for more than 7 days, 25% display significant muscle weakness, and approximately 90% of long-term ICU survivors will have ongoing muscle weakness. Prolonged stays in the intensive care unit are also associated with impaired quality of life, functional decline and increased morbidity, mortality, cost of care and length of hospital stay [11].

METHODS

Study design

A quantitative, quasi-experimental design was carried out through the test-retest method of a pretest and post-test I, then post-test II; application for both study group and control group of critical care units nurses to determine the effectiveness of an interventional program toward TPN in ICU nurses

Setting and period

The study was conducted among nurses who work in three adult critical care units at Medical City Complex included (Ghazi Al-Hariri Teaching Hospital, Baghdad Teaching Hospital, Nursing Home Teaching Hospital) in Baghdad city between July 1, 2023, and January 28, 2024. Intensive care units have a total of 42 beds, and the total number of nurses working in three critical care units was 150.

Study Participant

The study population was all CCU staff nurses who were available during data collection time and worked in adult intensive care units for one-year experience in teaching hospitals in Baghdad, Iraq.

Inclusion and exclusion criteria

All permanent staff nurses working at the selected hospitals included 3 critical care units. The inclusion criteria were being nurses working in the selected CCUs for at least one year, caring for critically ill, and being available during the study period. Exclusion criteria: staff nurses who were not cooperating to fill out the administered questionnaire were excluded.

Sampling and sample size

A non - probability purposive sample was selected from nurses working in ICU at a Teaching Hospitals in Baghdad city. The sample consist of (80) nurses, which are divided into two groups (40) nurses considered as study group, and (40) nurses are considered as a (control group)

Study instruments and data collection

Study Instrument: Part-1: This part included a covering letter to obtain the nurses' agreements (written consents) to participate in this study**. Part-2**: Socio-Demographic Data Sheet: This part dealt with socio-demographic nurses' characteristics (age, gender, educational level, Marital Status, years of nursing experience, years of ICU experience). **Part-3:** Observational checklist about nurses' practice toward TPN administration Consist of Three observations and divided into Fourth parts (Equipment's, Preparation, Performance, Evaluation), the tool designed as (applied {correctly, not correctly} & not applied) the scoring system of the scale consists of (3) types of a score; for the correctly applied (3), not correctly applied (2) & not applied (0), the tool consisted of Fourth domains. The first domain (Equipment's) consist of 5 questions, second domain (Prepartion) consist of 5 questions, third domain (Performance) consist of 20 questions, fourth domain (Evaluation) consist of 2 question.

Ethical considerations

. Both groups of participants received informed Ethics Committee reviewed the dissertation proposal, ethical approval was issued. The authorized permission was gained from the College of Nursing at University of Baghdad to conduct the study. An

official permit was also obtained from the Medical City Health: Directorate. Informed consent, which was distributed to them to guarantee their permission and agreement to enroll in the present study. They were also told that they might leave the research at any moment and that their participation was entirely optional. Emphasis was made to create an appropriate and healthy environment using good communication skills with participant

Statistical analysis

Descriptive and inferential statistical procedures were conducted. The descriptive analysis was presented with frequency, percentage, and mean and standard deviation. The Chi square test was employed to indicate the significant difference between study and control groups for the sociodemographic characteristics, T-test it is utilized to determine differences and compare (2) means (x a and x b) of the two groups, study and control groups, ANOVA it was used to determine the association between socio-demographic characteristics and the nurses' knowledge Statistically significant when the *p*-value is < 0.05. All the data were analyzed with SPSS Statistics (version 26).

Results

Our study encompassed 80 nurses' participants. Table 1 displays demographic characteristics of the nurses. The mean age of the participants was 29.02±8.06years for study group and for control group 40.17±7.89. The majority of respondents were female for study group and male for control group, the level of education was institution graduation for both groups.

The highest percentage of the study groups were single and the control groups were married The highest percentage (62.5) of the study groups were (1-5) years' experience while the highest percentage of the control groups (45%) were (6-10) years' experience There were no statistical significant differences were observed between the study and control group related to age, gender, level of education, marital status, number of years' experience in ICU at p-value (0.001).

Table (1): Distribution of the Studied Sample According to Socio-Demographical Characteristics

χ^2: chi-square, df: degree of freedom, P-value, Sig: Significant

Socio-Demographic Variables	Study group (n=40)		Control group (n=40)		χ^2	Df	P-value	Sig
Age/Years	**No.**	**%**	**No.**	**%**				
20-29years	14	**35.0**	10	25.0	11.440	3	0. 247	NS
30-39years	13	32.5	10	25.0				
40-49years	10	25.0	14	**35.0**				
50-59years	3	7.5	6	15.0				
Total	40	100.0	40	100.0				
$\bar{x} \mp SD$	**29.025±8.06222**		**40.1750±7.89316**					
Gender								
Male	19	47.5	21	**52.5**	1.568	1	0.210	NS
Female	21	**52.5**	19	47.5				
Total	40	100.0	40	100.0				
Level of Education of the Study Sample								
Nursing high school graduate	3	7.5	8	20.0	12.460	4	0.189	NS
Institution graduate	20	**50.0**	16	**40.0**				
College graduate	14	35	15	37.5				
Higher Diploma	-	-	1	2.5				
Master Degree	3	7.5	-	-				
Total	40	100.0	40	100.0				
Marital Status for the Study Sample								
Married	26	**65.0**	13	32.5	3.357	2	0.187	NS
Single	13	32.5	27	**67.5**				
Divorced	1	2.5	-	-				
Total	40	100.0	40	100.0				
Number of years' Experience in ICU								
1-5years	25	**62.5**	17	42.5	5.724	3	0.767	NS
6-10years	9	27.5	18	**45.0**				
11-15years	3	7.5	3	7.5				
16-20years	3	7.5	2	5.0				
Total	40	100.0	40	100.0				
$\bar{x} \mp SD$	**4.7250±4.230463**		**6.8750±5.00352**					

Table (2): Statistical Comparison between Nurses' Practice about Parenteral Nutrition among Study and Control Group

Study Group (N=40)				Control Group (N=40)				T-test			
Items	**M.S**	**SD**	**ASS.**	**Items**	**M.S**	**SD**	**ASS.**	**Value**	**df**	**P-value**	**Sig.**
Pre-test	20.85	4.56	L	**Pre-test**	19.7	4.43	L	1.213	39	0.445	**NS**
Post-test1	61.25	7.82	H	**Post-test1**	19.35	4.39	L	54.752	39	0.000	**HS**
Post-test 2	62.57	7.91	H	**Post-test2**	18.87	4.34	L	71.155	39	0.000	**HS**

M: Mean of total score, SD Standard 'deviation of total score, ASS: Assess: T-test, df: Degree of freedom, P-Value: Probability value, sig.: Significant, NS: Nonsignificant, HS: Highly significant, L: low, M: Moderate, H: High, Low:0-21.3, Moderate:21.4-42.6, High: 42.7-64.

Table (2) shows the overall assessment of nurses' practice about parenteral nutrition; the findings reveals that nurses in the study group are showing low level of practice during the pre-test time (M ±SD = 20.85 ±4.56) while they are showing high level of practice during the post-test1 (M ±SD = 61.25 ±7.82) and post-test2 (M ±SD = 62.57 ±7.91) that indicate the clear changes in nurses' practice after applying interventional program. The nurses in the control group are showing low level of practice during the three times of test: pre-test (M ±SD= 19.7 ±4.43), post-test1 (M ±SD = 19.35 ±4.39), and post-test2 (M ±SD = 18.87 ±4.34) that indicate no clear changes in nurses 'practice.

There were no statistical significant differences were observed between pretest items for both study and control groups at p-value (0.445) that indicate no significant changes of nurses' practice and there were highly statistical significant differences were observed between posttest1 and posttest2 items for both study and control groups at p-value (0.001) that indicates significant changes of nurses' practice after applying interventional program.

Table (3) The Relationship between Nurses' Practice among Study and control group

Items	Score	Group	N	M.S	SD	T.test	P-value	Sig.
Practice	Pre-test	Study	40	20.85	4.56			
	Posttest1	Study	40	61.25	7.82	-68.493	0.000	HS
	Pre-test	Study	40	20.85	4.56			
	Posttest2	Study	40	62.57	7.91	-69.272	0.000	HS
	Posttest1	Study	40	61.25	7.82			
		Control	40	19.35	4.39	54.752	0.000	HS
	Posttest2	Study	40	62.57	7.91			
		Control	40	18.87	4.34	71.155	0.000	HS

M: Mean of total score, SD Standard deviation of total score, T: T-test, P-Value: Probability value, sig.: Significant, HS: Highly significant, df: for all items (39).

Table (3) Shows that there was a statically significant differences in nurse' practice between study group in pre and posttest time at p-value (0.001) and there was a statistically significant differences in nurses' practice between study and control group in pre and posttest time at p-value (0.001).

Table (4): Differences between Nurses' Practice with their Sociodemographic Characteristics for Study Group at posttest

Variables	ANOVA	Sum of Squares	df	Mean of Square	F	P-value	Sig.
Age	Between Groups	0.638	6	0.114	0.093	0.997	NS
	Within Groups	40.292	33	1.221			
	Total	40.975	39				
Level of education	Between Groups	5.253	6	0.875	1.005	0.439	NS
	Within Groups	28.747	33	0.871			
	Total	34.000	39				
Marital Status	Between Groups	2.703	6	0.450	1.714	0.149	NS
	Within Groups	8.672	33	0.263			
	Total	11.375	39				
Total Number of years' experience in Nursing	Between Groups	38.369	6	6.395	0.318	0.923	NS
	Within Groups	663.406	33	20.103			
	Total	701.775	39				
Number of years' experience in ICU	Between Groups	33.828	6	5.638	0.280	0.942	NS
	Within Groups	664.147	33	20.126			
	Total	697.975	39				

ANOVA: Analysis of Variance, Sum of Squares, df: Degree of freedom, Mean of Square, F: Fisher test, P-value: Probability, sig. Significant, NS: non-significant

Table (4) Shows that there were no statistically significant differences in nurses' practice and their sociodemographic characteristics regarding (Age, Level of education, Marital status, Total Number of year' experience in nursing and number of years' experience in ICU).

Discussion

These findings demonstrated that both the study and control groups are not similar in age. The study group with young nurses' age which was good result because the age of peak production for this sample group was (29) years old so that the training was important to apply interventional program for those group to enhance their experience toward parenteral nutrition while the control group (40) years old which is better than other age groups for a nurse to have good

experience and patience, and nurses' age is more suitable for work in ICU because they can pay close attention and provide adequate care for their patients. This finding agree with study shows that the majority of participants were female with age (20-29) years with diploma and more half was married, years of experience in nursing and intensive care unit were (1-5) years, quality of care before, during, and after at fair level. [12,27,28]

Both male and female nurses at the ICU were interested in participating in the study based on observations made during the execution of the interventional program. The findings revealed that the research group's male members' highest percentage account for 52.5% of the total, while female participants account for 52.5% for both study and control group. study conducted on nurses working in the intensive care unit at AL-Hussein Medical City Hospital was purposefully selected and divided into two groups: thirty nurses as the study group were exposed to the nursing education program, and thirty nurses as the control group were not exposed to the program, according to this study male nurses were 21 (70%) and female nurses 9 (30%). [13]

The majority of study participants were diploma graduated this supported by the study. Assessment of Critical Care Nursese'knowledge and Practice Regarding Care of Patients Undergoing Total Parenteral Nutrition in Helwan university in Egypt that the majority of participants were Technical institute of nursing (n=26;52%), Bachelor of nursing (n=11; 22%), Diploma (n=10;20%), Master degree (n=3;6%. [14, 15]

The majority of the study samples (65%) of the study groups were married and (67.5%) of the control groups were single. This agree with study conducted in in the critical care units in AL - Hilla Teaching Hospitals, from the period (Sep.2018 to Aug .2019). Non-probability (purposive) sample were assigned to

achieve the objectives of the study, (60) nurses divided to control and trail group The presented that most of the study samples were married and also supported by the study conducted in ICU that the majority were married (n=50,50%). [15,23]

The majority (62.5%) of the study groups had worked in ICU between (1-5) years of nursing experience, whereas approximately (45.0%) of the control groups had worked in ICU between (6-10) years of nursing experience. In agreement to the study Nursing staff knowledge of parenteral nutrition – preliminary report in Poland. The highest percentage of staff surveyed had worked in the profession for 1-5 years' experience and also supported by the study in critical care unit at al Diwaniya teaching hospitals. The highest percentage (n=16; 59% and n=18; 67%) concerning years of experience in the nursing field and years of experience in ICU [16,21, 24,25]

The result of testing the significance of the questionnaire items revealed a majority of highly significant differences at p-value (0.001), indicating the effectiveness of the studied interventional program by increasing the practice levels of the study group's nurses staff, and thus confirming the importance or success of implementing the suggested program. This supported by the study in their study Interventional Nursing Program for Nurses Practices about Enteral Feeding Guidelines in Critical Units. The findings reveal that nurses in the study group are showing poor level of practice during the pre-test time (92% M±SD= 46.72±1.882) while they are showing good level of practice during the pos-test1 (96% M±SD=119.04± 1.904) and post-test 2 (92% M± SD= 117.16± 3.223) that indicates significant changes in level of practices among nurses' after applying the program there was a significant difference. another study which conducted on 60 nurses, in Ain Shams University Hospital in Cairo, Egypt to measure the effect of the implemented guidelines program about

nursing care of TPN in ICU nurses on the educational outcomes, the study has shown that. The program had a significant positive impact on nurses' knowledge and practice outcomes. [17, 20]

there is a statistically significant difference in nurses' practice between study group in pre and posttest time at p-value (0.001) and there is a statically significant difference in nurses' practice between study and control group in pre and posttest time at p-value (0.001). This supported by the study, Effect of Training Program on Nurses knowledge and practice about Total Parenteral Nutrition. That there was a statistical significance differences between nurses' practice before and after implementation of the training program at P-value (0.001). [18,26]

The finding shows there were no statistically significant differences in nurses' knowledge and their sociodemographic characteristics regarding (Age, gender, level of education, Marital status, and number of years' experience in ICU). at p- value $\leq$ 0. 05. The results supported by study, Effect of Training Program on Nurses knowledge and practice about Total Parenteral Nutrition that there were no statistical significant differences between nurses' practices and their demographic characteristics and another study have assessed the effect of an educational program on nurses' practices regarding the nutrition support, they founded in their study that there was no significant relationship between nurses' practices regarding nutrition support and their age, gender, marital status. [18,17,19,22]

Conclusions

The Study concluded that the nurses' practice toward parenteral nutrition in critical care units was inadequate at pretest. There was positive affect of interventional program in the improvement of the nursing staffs' practice

toward parenteral nutrition in critical care units. After a post-test for a study group toward parenteral nutrition nurses' practice, there was an increase in nurses' practice. In comparison, the control group did not show any progress in their practice toward parenteral nutrition at the pre and posttest. There were no significant relationships between nurses' knowledge and their demographic characteristics (Age, gender, marital status, level of education, total number of years' experience in nursing, number of years' experience in ICU).

Recommendations

The study recommended to examine the barriers to implementing evidence-based nutritional support techniques in a clinical setting. Emphasize nutrition as a therapy for critically ill patients because of its importance in improving their outcomes. Developing the educational program toward parenteral nutrition during academic stages for nursing students. Special and continuing educational program should be established and applied for nurses who are working in intensive care units concerning parenteral nutrition

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