

Effectiveness of an Educational Program on Nurses' Knowledge about Parenteral Nutrition in Critical Care Units

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ABSTRACT

Background: Total Parenteral Nutrition (TPN) is an intravenous nutrition administered to patients, unable or unwilling to undergo enteral nutrition. It is particularly relevant for those experiencing conditions such as intestinal failure, paralytic ileus, bowel ischemia, and others. **Objective:** To evaluate critical care nurses' knowledge regarding parenteral nutrition, measure the effectiveness of an intervention program on this knowledge, and determine the relationship between nurses' knowledge and their demographic data. **Methods:** A quasi-experimental design study was conducted using a purposive sampling technique. 110 nurses were recruited from three intensive care units in Baghdad City, Iraq. The study was conducted from July 1st, 2023, to January 28th, 2024. A Likert scale was used to assess nurses' knowledge after the researcher's permission, which consisted of three parts: the first part, written and oral informed consent; the second part, a socio-demographic data sheet; and the third part, a questionnaire to assess nurses' knowledge about parenteral nutrition. **Results:** The study collected data on nurses' knowledge level in two groups—a control group and a study group—across three tests: pre-test, post-test1, and post-test2. The results showed that the nurses in the control group had a consistently low level of knowledge across all three tests (pre-test: $M \pm SD = 60.27 \pm 5.56$, post-test1: $M \pm SD = 63.15 \pm 5.44$, post-test2: $M \pm SD = 65.90 \pm 6.61$), indicating no clear change in their knowledge level. On the other hand, nurses in the study group had a low level of knowledge during the pre-test ($M \pm SD = 60.30 \pm 3.14$). Still, they showed a clear increase in their understanding during post-test1 ($M \pm SD = 94.47 \pm 2.29$) and post-test2 ($M \pm SD = 96.40 \pm 2.07$), indicating a clear improvement in their knowledge level after completing an educational program. The data was analysed using SPSS version 26. **Conclusion:** This study concluded that interventional programs improved the nursing staff's knowledge of parenteral nutrition in critical care units. There were no significant relationships between nurses' knowledge and their demographic characteristics. In addition, there was a significant relationship between the level of education and their nurses' knowledge of parenteral nutrition.

Keywords: Critical Care Units; Educational Program; Effectiveness; Nurses' Knowledge; Total Parenteral Nutrition

INTRODUCTION

Nutrition refers to consuming essential nutrients necessary for the growth and regeneration of tissues and organs, ensuring proper functioning. Malnutrition can result in a wide range of consequences, such as diminished growth, delayed wound healing, immunosuppression, reduced skeletal muscle mass, intestinal mucosa atrophy, edema, and cognitive impairment. The incidence of hospitalization, illness, and mortality has been showing a rise, with malnutrition emerging as a significant contributing factor. (Doganay & Ulger, 2022)

Nutritional therapy plays a crucial role in managing critically ill patients as it facilitates the provision of energy and essential nutrients, thereby minimizing the occurrence of malnutrition. Furthermore, nutritional therapy is crucial for the pathophysiological alterations and clinical manifestations of diseases. (Ahmed & Hassan, 2021)

A critical illness that requires essential organ support is typically associated with an immediate

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inflammatory reaction and needs bed rest, both of which contribute to the deterioration of lean body mass. The mentioned alterations elevate the likelihood of malnutrition or exacerbate pre-existing malnutrition, leading to higher morbidity and mortality (Stapleton, Jones, & Heyland, 2017). To sustain metabolic functioning and prevent underfeeding resulting from complications, critically ill patients depend on artificial nourishment. The intensivist should prioritize providing adequate nutrients and energy levels, like their focus on hydration and pain management. Primary care involves administering comprehensive interventions, including food, painkillers, sedatives, thromboembolic prophylaxis, head-of-bed elevation, stress ulcer prophylaxis, and glycemic management, to promote optimal patient outcomes (Vincent, 2018).

Parenteral nutrition (PN) is used when oral or enteral nutrition (EN) is not possible or satisfactory. PN includes carbohydrates, lipids, amino acids, vitamins, trace elements, electrolytes, and water. Due to its hypertonic nature, it is recommended that PN be administered through a central line. Nevertheless, peripheral PN (with reduced nutritional concentration and increased volume) can be delivered through a suitable non-central line. The compounding method can be supplemented with various options, such as hospital pharmacy compounded and commercial multichambered bags. When administering PN, it is essential to consider multiple elements, such as the timing of initiation, the patient's clinical condition, and potential consequences. Parenteral nutrition (PN) administration is limited to venous access, which either peripheral or central venous catheters can accomplish (Berlana, 2022; Mohammed *et al.*, 2024).

The method of administering total parenteral nourishment involves using a central venous catheter. An access device known as a central venous catheter is utilized to administer nutrition, medication, chemotherapy, and other medical interventions. It terminates either in the superior vena cava or the right atrium. Access can be established by various methods, including using a peripherally inserted central catheter (PICC), a central venous catheter, or an implanted port (Kovacevich *et al.*, 2019).

Medical practitioners can introduce a PICC line into the basilic, cephalic, brachial, or median cubital vein. The preference for the basilic vein arises from its larger size and superficial positioning. The catheter passes the basilic vein, enters the axillary vein, reaches the subclavian vein, and ultimately reaches the superior vena cava. PICC lines are suitable for administering TPN over many weeks or months (Gonzalez & Cassaro, 2017).

Nurses assume a crucial role in managing patients receiving total parenteral nutrition (TPN), encompassing tasks such as maintaining the catheter and delivery system, preparing and administering TPN solutions, changing dressings at the catheter insertion site, and regularly replacing the infusion set. Nursing personnel treating patients in a critical care unit undergoing total parenteral nutrition (TPN) must comprehensively understand its nutritional management (Faris & Abed, 2022).

Registered nurses must thoroughly understand the indications for utilizing Total Parenteral Nutrition (TPN) and the potential hazards and concerns associated with its administration. Along with the knowledge of TPN, nurses must possess essential skills such as executing precise calculations, mixing TPN solutions, and being vigilant in observing for indications of adverse reactions or complications (Sakran & Hattab, 2023).

Long-term physical and psychological consequences are commonly experienced by individuals who are seriously ill. Among patients who have been mechanically ventilated for a duration beyond seven days, 25% exhibit notable muscle weakness, while nearly 90% of individuals who survive in the intensive care unit for an extended period will continue to experience muscle weakness. Extended durations of stay in the intensive care unit are linked to diminished quality of life, a reduction in functional abilities, and heightened rates of morbidity, mortality, health care costs, and length of hospitalization (Neamah, 2019).

METHODOLOGY

Study Design

A quasi-experimental study was conducted using a quantitative design involving the test-retest method of a pretest, post-test I, and post-test II. The aim was to evaluate the effectiveness of an educational program on total parenteral nutrition (TPN) among critical care unit nurses in both the study and control groups.

Setting and Period

The research was conducted on 110 nurses who were working in three adult critical care units at three

hospitals in Baghdad City: Ghazi Al-Hariri Teaching Hospital, Baghdad Teaching Hospital, and Private Nursing Home Teaching Hospital. The study was conducted between January 2, 2023, and March 8, 2024.

Study Participant

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

Inclusion and Exclusion Criteria

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

Sampling and Sample Size

A non-probability purposive sample of 80 nurses working in the ICU at a teaching hospital in Baghdad city was selected. The sample was divided into two groups: a study group of 40 nurses and a control group of 40 nurses.

Target Population

110 nurses work in the ICU. The minimum sample size is 110 according to the population of 150 ICU nurses and a 95% level of confidence with a margin of error.

$$\text{Unlimited population: } n = \frac{z^2 \times \hat{p}(1-\hat{p})}{\epsilon^2}$$

$$\text{Finite population: } n' = \frac{n}{1 + \frac{z^2 \times \hat{p}(1-\hat{p})}{\epsilon^2 N}}$$

where: z is z score

\hat{p} is the population proportion

n and n' are sample size

N is the population size (Raosoft Sample Size Calculator, 2013).

Nurses who shared in the preliminary assessment need were excluded from the study; ten (10) critical care nurses who participated in the pilot study were also excluded from the study; ten (10) nurses who did not meet the inclusion criteria and refused to complete post-tests were excluded. The remaining study subjects were divided into two groups, each with 40 critical care nurses. The remaining study subjects were divided into two groups, each with 40 critical care nurses.

Study Instruments and Data Collection

Study Instrument: Part 1 included a cover 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, and years of ICU experience). Part 3: Questionnaire to assess nurses' knowledge about parental nutrition: Multiple-choice questions about nurses' knowledge of the TPN, as well as accurate and false, were used in this part. The knowledge assessment test consists of 50 multiple-choice questions (MCQs) and (T, F) divided into three parts. (7) options to answer each question in the first part for the second and third parts; (4) options. All items were designed using MCQs and T and F with one correct answer. In addition, the tool was developed using a two-level Likert scale (accurate and incorrect) to evaluate nurses' knowledge of the TPN. The scoring system of the scale consists of two types of scores: (2) for the correct answer and (1) for the incorrect answer. The educational program was exclusively introduced to the study group and comprised three significant sessions. Each session was meticulously designed and scheduled to last between 90 and 120 minutes, with one session scheduled on each consecutive day. These sessions focused on enhancing knowledge related to Total Parenteral Nutrition (TPN).

Table 1 shows the implementation of the interventional program, which commenced on July 11th, 2023,

and concluded on October 15th, 2023. Throughout the program, the researchers employed various audio-visual aids, including PowerPoint presentations, specific session techniques, and planned activities aimed at facilitating engagement and interaction among participants. Techniques such as brainstorming and soliciting audience feedback were incorporated into each session to encourage active participation and discussion among the nurses involved.

Table 1: The Details and Content of the Educational Program

Weeks	Content
First Week	Nutrition & Nutritional Support
First session (9 th -13 th July) Time: 1hour Place: Medical City Directorate at ICU	Nutrition & Nutritional Support Practice Guidelines for Nutrition in Critical Ill Patient Benefits of Adequate Nutrition Approach to Determine Nutritional Status Assessment of Nutritional Status in Critical Ill Patients
Second Week	Parenteral Nutrition
Second session (16 th -20 th July) Time: 1hour Place: Medical City Directorate at ICU	Parenteral Nutrition Indications TPN Formulas and Constituent Nutritional Additives Components of Immunity Enhancing Formula PN Daily Requirements for Trace Elements and Vitamins The Most Important Complications for Parenteral Nutrition (Refeeding Syndrome) Treatment and Management of Refeeding Syndrome ESPEN Guidelines for Adult Parenteral Nutrition
Third Week	The Main Complications of Parenteral Nutrition
Third session (23 ^h -27 th July) Time: 1hour Place: Medical City Directorate at ICU	The Main Complications of Parenteral Nutrition Nursing Intervention for each Complication Methods of Giving Parenteral Nutrition Initiating Therapy Administration Methods

Validity and Reliability of the Instrument

A panel of 16 experts in nursing, education, and medicine determined the validity of the study instruments. A copy of the study instruments was provided to experts' members to assess the instruments to adequacy and content clarity. Some items were added after, and some were excluded; all the recommendations and comments were considered. The questionnaires were considered valid after performing the adjustments, depending on the experts' responses. Nonprobability sampling was selected purposively of the ten nurses from Medical City Directorate Hospital throughout the interviewing to ensure the instrument's reliability from July 16 to July 30, 2023. This sample was excluded from the final sample. The use of test-retest reliability for the questionnaire was calculated. A nurse administered the questionnaire. After fifteen days, the same tool was administered without any manipulation to the same nurses. The researcher finds out the stability by computing the instrument's Pearson coefficient using SPSS version 26. The results found that the coefficient of correlation was ($r = 0.908$) at the level ($p \leq 0.05$) for nurses' knowledge; such estimations have been statistically adequate and significant. This is statistically acceptable compared with the standard lower bound of the reliability coefficient, so the questionnaire was considered reliable (Gu, Emons, & Sijtsma, 2021).

Statistical Analysis

Descriptive and inferential statistical procedures were performed. The descriptive analysis included frequency, percentage, meaning, and standard deviation. The study employed statistical tests to identify significant differences between the study and control groups based on their sociodemographic characteristics. The *T*-test was used to compare the means of the two groups, while an ANOVA was used to determine the association between socio-demographic factors and the nurses' knowledge. The chi-square test was utilized to indicate the significance of the difference between the groups. The results were considered statistically significant when the *p*-value was less than 0.05. The data were analyzed using the SPSS Statistics software version 26.

Ethical Consideration

This study received ethical approval from the College of Nursing, University of Baghdad, Iraq, to conduct the study with reference no. 1991 on June 8, 2023. An official permit was also obtained from the Medical City Health Directorate with reference no. 23614 on 22nd June, 2023.

RESULTS

The study encompassed 80 nurse participants. Table 2 displays the demographic characteristics of the nurses. The mean age of the participants was 29.02±8.06 years for the study group and 40.17±7.89 years for the control group. The majority of respondents were female for the study group and male for the 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 was (1–5) years of experience, while the highest rate of the control groups (45%) was (6–10) years of exterior fence. No statistically significant differences were observed between the study and control group related to age, gender, level of education, marital status, and number of years of experience in ICU at *p*-value (0.001).

Table 2: Distribution of the Studied Sample According to Socio-Demographical Characteristics Variables

Study		Group (N=40)		Control Group (N=40)			T-test				
Item	M.S	SD	ASS.	Items	M.S	SD	ASS.	Value	df	P-value	Sig.
Pre-test	60.30	3.14	L	Pre-test	60.27	5.56	L	0.02	39	0.632	NS
Post-test	94.47	2.29	H	Post-test1	63.15	5.44	L	35.824	39	0.000	HS
Post-test 2	96.40	2.07	H	Post-test2	65.90	6.61	L	28.813	39	0.000	HS

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

Table 3: Statistical Comparison Between Nurses' Knowledge of Parenteral Nutrition Among Study and Control Group

Socio-Demographic Variables	Study group (n=40)		Control group (n=40)		<i>χ</i> ²	<i>df</i>	<i>P</i> -value	Sig
	No.	%	No.	%				
Age/Years					11.440	3	0.247	NS
20-29years	14	35.0	10	25.0				
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				
$\bar{x} \pm SD$	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's 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 of 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				
$\bar{x} \pm SD$	4.7250±4.230463		6.8750±5.00352					

The mean of the total score, SD Standard deviation of the 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: 50-66.66, Moderate: 66.67-83.33, High: 83.34-100. Table 3 presents the overall evaluation of nurses' knowledge regarding parenteral nutrition. The results indicate that the nurses in the study group had a low level of expertise during the pre-test ($M \pm SD = 60.30 \pm 3.14$). However, they showed a high level of knowledge during post-test 1 ($M \pm SD = 94.47 \pm 2.29$) and post-test 2 ($M \pm SD = 96.40 \pm 2.07$) after undergoing an educational program. These findings suggest a significant improvement in the nurses' knowledge after implementing the academic program. The nurses in the control group displayed a low level of knowledge during the three testing periods: pre-test ($M \pm SD = 60.27 \pm 5.56$), post-test1 ($M \pm SD = 63.15 \pm 5.44$), and post-test2 ($M \pm SD = 65.90 \pm 6.61$). This indicates no significant change in the nurses' knowledge throughout the study.

No significant differences were observed between the pretest items for both the study and control groups at a *p*-value of 0.632. This suggests that the nurses' knowledge remained relatively the same before applying to the educational program. However, highly significant differences were observed between the posttest1 and posttest2 items for the study and control groups at a *p*-value of 0.001. This indicates substantial improvements in the nurses' knowledge after applying the educational program.

Table 4: The Relationship between Nurses' Knowledge among Study and Control Group

Items	Score	Group	N	MS	SD	T-test	P-value	Sig.
Knowledge	Pre-test	Study	40	60.30	3.14	-73.228	0.000	HS
	Posttest1	Study	40	94.47	2.29			
	Pre-test	Study	40	60.30	3.14	-64.308	0.000	HS
	Posttest2	Study	40	96.40	2.07			
	Posttest1	Study	40	94.47	2.29	35.824	0.000	HS
		Control	40	63.15	5.44			
	Posttest2	Study	40	96.40	2.07	28.813	0.000	HS
		Control	40	65.90	6.61			

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

Table 4 shows that there was a statistically significant difference in nurses' knowledge between the study group in pre- and post-test time at *p*-value (0.001), and there was a statistically significant difference in nurses' knowledge between the study and control groups in pre- and post-test time at *p*-value (0.001).

Table 5: Differences between Nurses' Knowledge of Their Sociodemographic Characteristics for the Study Group at Posttest

Variables	ANOVA	Sum of Squares	Df	Mean of Square	F	P-value	Sig.
Age	Between Groups	13.465	10	1.347	1.741	0.119	NS
	Within Groups	22.435	29	0.774			
	Total	35.900	39				

Level of education	Between Groups	19.298	10	1.930	3.806	0.002	HS
	Within Groups	14.702	29	0.507			
	Total	34.000	39				
Marital Status	Between Groups	1.030	10	0.103	0.289	0.979	NS
	Within Groups	10.345	29	0.357			
	Total	11.375	39				
Total Number of years' experience in Nursing	Between Groups	7.796	10	0.780	0.894	0.551	NS
	Within Groups	25.304	29	0.873			
	Total	33.100	39				
Number of years' experience in ICU	Between Groups	8.011	10	0.801	0.908	0.539	NS
	Within Groups	25.589	29	0.882			
	Total	33.600	39				

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

Table 5 shows that there were no statistically significant differences in nurses' knowledge and their sociodemographic characteristics regarding age, marital status, total number of years of experience in nursing, and years of experience in ICU. There were statistically significant differences in nurses' knowledge and their level of education.

DISCUSSION

Critical care nurses are the primary ones responsible for the delivery of feeding for critically ill patients. Hence, their knowledge is significant for ensuring the delivery of adequate nutritional support for their patients. The present study was conducted to investigate the impact of an educational program on the knowledge of nurses regarding total parenteral nutrition in intensive care units. The findings of the study showed that the study group had significantly better and more stable knowledge results than the control group, demonstrating the effectiveness of the educational program. This confirms the importance and success of the program's implementation. Finally, the significant improvements observed suggest that there were substantial initial knowledge gaps, which the educational program effectively targeted, resulting in noticeable advancements in both knowledge and practice.

These factors highlight the comprehensive and multifaceted approach of the educational program, ensuring it was well-designed to meet the specific needs of ICU nurses in the context of TPN administration. Studies conducted in South Korea (27), Saudi Arabia (28), Egypt (29), and Iraq (30) found that nurses significantly improved their understanding and knowledge of enteral nutrition for ICU patients after the training program. Ahmed & Hassan (2021) reported a highly statistically significant difference in the total knowledge and practice levels of nurses before and after the implementation of guidelines. Elsayed (2021) highlighted the effectiveness of the NGT feeding educational interventions in enhancing the knowledge and performance of the studied nurses. Jeesh, Khalid and Elbashier (2021) also noted a remarkable and varied improvement in nurses' performance after they received the education program. This study's findings indicate differences in the age distributions between the study and control groups. The control group, consisting of 40-year-old nurses, demonstrates more excellent expertise and patience than other age groups. Additionally, nurses' age is particularly appropriate for working in ICUs due to their ability to monitor patients and deliver sufficient care closely. Including a study group of young nurses yielded favorable outcomes because the age at which peak output occurred within this sample group was 29 years. Consequently, it was crucial to implement an interventional program for this group to strengthen their experience with parenteral nutrition. This data aligns with a study indicating that most participants were female, aged between 20 and 29 years, and possessed a

diploma. Additionally, more than half of the participants were married. The participants had varying years of experience in nursing and intensive care units, ranging from 1 to 5 years. The quality of care provided before, during, and after the study was deemed to be at a fair level. (Faris & Abed, 2022; Hattab, Kadhim & Abdulwahhab, 2021).

The study received interest from male and female nurses working in the intensive care unit (ICU), as evidenced by observations made during the implementation of the interventional program. The results indicated that the research group consisted primarily of males, comprising 52.5% of the sample. Additionally, female participants constituted 52.5% of the study and control groups. An intentional study was conducted on nurses employed in the intensive care unit at Al-Hussein Medical City Hospital. The study group consisted of thirty nurses who were exposed to a nursing education program, while the control group comprised thirty nurses who were not exposed to the program. The study revealed that out of the total number of nurses, 21 (70%) were male and 9 (30%) were female.

The study findings indicate that a significant proportion of the participants obtained a diploma, as noted in the data. The study conducted at Helwan University in Egypt aimed to evaluate the knowledge and practice of critical care nurses in caring for patients undergoing total parenteral nutrition. The majority of participants in the study were from the Technical Institute of Nursing ($n = 26$; 52%), Bachelor of Nursing ($n = 11$; 22%), Diploma ($n = 10$; 20%), and master's degree ($n = 3$; 6%).

65% of the study groups were married, while 67.5% of the control groups were single. This confirms the findings of a study conducted in the critical care units at AL-Hilla Teaching Hospitals from September 2018 to August 2019. To meet the study's objectives, a non-probability (purposive) sample of 60 nurses was assigned to the control and trial groups. It was found that most of the study samples were married, which was further confirmed by the study done at the Intensive Care Unit (ICU), where most participants were married ($n = 50$). (Abo Aita, Aboelfetoh, & Mahmoud, 2022).

Approximately 62.5% of the study groups possessed 1-5 years of nursing experience in the ICU, while around 45.0% of the control groups possessed 6-10 years of nursing experience in the ICU. A preliminary report was prepared in Poland based on research conducted on the expertise of nursing personnel regarding parenteral nutrition. Most of the surveyed staff had acquired 1-5 years of experience in the profession, further confirmed by the study conducted at the critical care unit at Al-Diwaniya teaching hospitals. The nursing field had the highest percentage of years of experience ($n=16$; 59%), whereas the ICU had the highest percentage of years of experience ($n=18$; 67%). (Aziz & Ali, 2020; Al-Rafay & Al-Sharkawy, 2019; Majeed *et al.*, 2023; Khudhayer & Adulwahhab, 2023)

The analysis of the questionnaire items demonstrated a significant majority of highly substantial differences at a p -value of 0.001. This suggests that the interventional program under investigation effectively enhanced the knowledge levels of the nurses in the study group. Consequently, the implementation of the proposed program is considered essential and successful. The study found significant statistical differences between the pre- and post-test results for the intervention program, with a p -value of 0.05. Additionally, there was a highly significant association between the success of the intervention program and the educational level of nurses and duration of employment at a significance level of $p \leq 0.05$. In a study conducted at Ain Shams University Hospital in Cairo, Egypt, a sample of 60 nurses was examined to assess the impact of an implemented guidelines program on the educational results of ICU nurses specializing in TPN nursing care. The findings of this study indicate that. The training showed a substantial and favorable influence on nurses' knowledge and practice outcomes. (Michalik & Kamińska, 2023; Al-Qalah & Alrubaiee, 2020)

There was a statistically significant disparity in nurses' knowledge between the study and control groups during the previous and post-test periods, with a p -value of 0.001. Additionally, there was a statistically significant distinction in nurses' knowledge between the study group and the control group during the pre- and post-test periods, with a p -value of 0.001. This statement has been confirmed by research on the impact of a training program on the knowledge and practice of nurses regarding total parenteral nutrition. A significant statistical difference was observed in nurses' knowledge before and after the execution of the training program,

as indicated by a *P*-value of 0.001. (Ahmed & Hassan, 2021; Hattab, Kadhim & Abdulwahhab, 2021).

The study's results indicate no statistically significant disparities in nurses' knowledge and sociodemographic characteristics regarding age, marital status, and years of experience in the intensive care unit (ICU). The *p*-value is ≤ 0.05 . There existed statistically significant disparities in the knowledge levels of nurses and their level of education, as indicated by a *p*-value ≥ 0.05 . The current study's findings suggest a strong and statistically significant association between the efficacy of the intervention program and demographic factors such as education level and duration of employment among the participants in the study ($p < 0.001$). Furthermore, another study referenced in their research indicated a significant correlation between nurses' knowledge of nutrition support and their level of education. Another investigation was undertaken in the intensive care unit (ICU). A notable disparity exists between the educational levels of nurses and their degree of knowledge. In contrast, no significant correlation is observed between age, gender, years of experience, and nurses' expertise. (Hussein & Sayed, 2021; Al-Rafay & Al-Sharkawy, 2019). Therefore, given that nurses in intensive care are in a key position to maintain patients' nutritional status at an optimal level and closer to nutritional goals (Das, 2014), major attention must be focused on nurses' knowledge and performance regarding nutritional status because nurses have the major responsibility for providing patients with their essential nutrients without causing complications. As well, continuous education and training of all hospital staff is essential to increasing their knowledge and practice about important nursing procedures (El-Meanawi, 2017).

CONCLUSION

The research findings indicate that the nurses' understanding of the parenteral nutrition in critical care units needed to be improved during the pretest session. The interventional program positively impacted the knowledge of nursing personnel regarding parenteral nutrition in critical care units. Following a post-test conducted on a study group focused on understanding parenteral nutrition nurses, there was a noticeable improvement in the nurses' knowledge. Conversely, the control group showed no rise in awareness of parenteral nutrition during the pre- and post-test. No significant connections were found between the knowledge of nurses and factors such as their age, gender, marital status, overall experience in nursing, and number of years of experience in the intensive care unit (ICU). However, a notable link was noticed between the educational level of nurses and their level of knowledge regarding parenteral nutrition.

The study evaluates the effectiveness of an educational program on nurses' knowledge about parenteral nutrition in critical care units. The present study faces several limitations, including sample size constraints, short follow-up durations, and reliance on self-reported measures. Subsequent investigations could address these issues by utilising more extensive and varied sample sizes, carrying out longitudinal analyses to evaluate enduring consequences, and combining objective and subjective evaluation techniques. To enhance comprehension of the program's efficacy and its practical implications for nursing practice in critical care settings, it would be beneficial to investigate variances in programme implementation and incorporate qualitative methodologies. These initiatives would help improve nursing expertise in the efficient management of parenteral feeding and refine teaching tactics.

Recommendation

The study recommended investigating the obstacles when integrating evidence-based nutritional support strategies within a clinical environment. Highlight the significance of diet as a therapeutic approach for critically ill patients due to its crucial role in enhancing their outcomes. This study aims to provide a curriculum focused on parenteral nutrition for nursing students during their academic phases. Creating and implementing a specialized and ongoing educational program for nurses employed in intensive care units is essential, explicitly focusing on parenteral nutrition.

Conflicts of Interest

The authors declare that they have no conflict of interests.

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