Effect of Educational Program on Nurses' Performance Regarding Total Parenteral Nutrition for High risk Neonate Undergoing Surgery

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Abstract

Background: Parenteral nutrition plays a critical role in the care of neonates undergoing surgery, impacting their recovery and long-term outcomes. **Aim of the study was**: This study aimed to evaluate the effect of educational program on nurses' performance regarding total parenteral nutrition for high risk neonate undergoing surgery. **Research design**: A quasi-experimental design was used in the actual study. **Sample**: A convenient sample (45nurse). **Setting**: The current study was conducted in the Neonatal intensive care unit (NICU) at Minia university hospital for obstetric and pediatric (MUHOP). **Tools**: Two tools; Tool (I): Structured Interview Questionnaire; Tool (II): Nurses' practices regarding administration of Total Parenteral Nutrition (observational checklist). **Results**: It was found that 89% of nurses had no knowledge in pre-test about TPN can be given at home while in post-test 85% of nurses had knowledge with statistically significance (P.0.05). Related to nurses practices about preparation of TPN there were37 % of nurses had incompetent practices in pre-test, while 93% of nurses had competent practices.This improve in nurses practices in post-test than pre-test reached statistically significant difference (P.0.034). **Conclusion**: nurses in the post-test had a higher satisfactory level of knowledge and practice about TPN compared to pre-test. The program was conducted over a period of three months from the beginning of April to the end of June 2024. **Recommendations**: Periodic educational programs for nurses toward parenteral nutrition high-risk neonates to enhance their knowledge and practices and reduce effects on high-risk neonates' outcomes.

Keywords: High-Risk Neonates', Nurses' Knowledge, Practices, Parenteral Nutrition

Introduction

First 28 days from birth is defined as the neonatal period and may be typed into the very early (birth to <24hr), early (birth to <7 days), and late neonatal periods 7 days to <28 days. Neonatal period is the most vulnerable time of human life for diseases and most of these are preventable **(Hadgu et al.,2020).**The term "high-risk neonates" identifies a group of neonates who very likely will acquired a severe acute illness or an adverse outcome **(Paolo et al.,2017).**

High Risk Neonate (HRN) is a neonate, regardless of Gestational Age (GA) or birth weight, who has a greater risk of morbidity or mortality, especially within the first 28 days of life. Neonatal Intensive Care Units (NICUs) are a critical aspect in maintaining the health and wellbeing of neonates in a hospital. High-risk neonates are mostly classified according to GA, birth weight and main pathophysiologic difficulties. Most common problems related to physiologic status involve the neonate's maturity, consequences of immature organs and systems such as jaundice, respiratory distress and chemical disturbances as hypoglycemia and hypocalcemia **(Said Hendy et al.,2020).**

Nutrition is an essential element of health, healing, and life itself. Nurses are in the unique position of monitoring their patients' dietary consumption, weight, and response to prescribed diets to make accurate assessments of their nutritional status. The parenteral nutrition skill set focuses on nutritional assessment, recognizing nutritional problems, and serving the needs of patients with changed nutrition. Preterm infants when it comes to getting the nourishment they need would face particular challenges. The

behavioral states of each neonate determine feeding readiness in preterm neonates **(Gomaa et al., 2022).**

Parenteral Nutrition is a necessary element of the nutritional and medical management of the premature infant. The fluid, macronutrient, and micronutrient requirements are unique to the premature infant due to their transition from the intrauterine to extrauterine environment, critically ill status, and lack of nutrient stores. It is necessary to improve product compatibilities, contamination, and availability when ordering parenteral nutrition. Avaibability of a multidisciplinary team is recommended for management of PN and its associated complications **(Barr et al., 2024).**

Nutritional support plays a critical role in the care of neonates undergoing surgery, impacting their recovery and long-term outcomes. Adequate nutrition is essential for maintaining tissue integrity, supporting immune function, and promoting growth and development, particularly during periods of increased metabolic demand such as surgery. However, providing optimal nutritional support in this population presents unique challenges due to factors such as immature gastrointestinal function, pre-existing malnutrition, and the potential for surgical complications **(Sahu et al ,. 2024).**

Nurses play an important part in the treatment of total parenteral nutrition TPN high risk neonate , 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 neonates in a critical care unit who are receiving TPN must be knowledgeable with its nutritional delivery **(Faris&Abed., 2022).**

Despite the evident benefits, Total Parenteral Nutrition treatment can cause health complications with potentially fatal outcomes. Besides problems related to venous access and catheter site infections, distinct adverse effects linked to the nutrition and metabolic conditions of the patients can manifest, including hyperglycemia, dehydration, electrolyte imbalance, thrombosis, encephalopathy, bone disorders, and liver injury. The latter, which is commonly known as PN-associated liver disease or intestinal failure-associated liver disease (IFALD), is one of such complications occurring during TPN treatment **(Mihajlovic et al., 2024).**

Significance of the study:

When enteral feeding is not possible, parenteral nutrition is a life-saving measure, parenteral nutrition is a complicated intervention that necessitates appropriate care and coordination from the start, throughout the treatment process, and at the end. It's also crucial to have a teaching program place to deal with the numerous challenges that arise while feeding high risk neonates. Although occasional nursing noncompliance with parenteral feeding guidelines has been observed, little is known about critical care nurses' expertise of parenteral nutrition **(Hussien &Sayed., 2021).**

PN is considered a “high-alert medication,” which can cause neonates harm, resulting in hospital pharmacies establishing policies to ensure safe delivery. Studies have reported high PN processing error rates; up to 20% of injectable medication errors were attributed to PN,10 46% of home PN prescriptions contained at least one discrepancy, and a general error rate on reviewing PN prescriptions was 1.6%. These results argue for regular interval quality improvement assessments regarding PN processing (**Kulyk et al,. 2025).**

Assessment of the Nurses’ Role toward Nutritional Therapy for High-Risk Neonates indicated that less than half of the studied nurses had an average level of total knowledge. More than half of them had an unsatisfactory level of practice and knowledge toward nutritional therapy for high-risk neonates **(Hesham et al., 2022)**

The study done by **Ambreen et al. (2022)** about the Impact of a standardized parenteral nutrition protocol: a quality improvement experience from a NICU of a developing country, found that PN was associated with shorter NICU stay and greater weight gain. Therefore, this study was performed to improve Nurses' performance regarding Total Parenteral Nutrition for high risk neonate undergoing surgery.

Aim of the study:

This study aimed to evaluate the effect of educational program on nurses' performance regarding total parenteral nutrition for high risk neonate undergoing surgery.

Research hypotheses:

To fulfill the aim of the current study the following research hypotheses were tested:

H1: Nurses who receive educational program will have higher level of knowledge and practice in post-program than pre-program

regarding total parenteral nutrition for high risk neonate undergoing surgery.

H2: Is there relation between nurses' knowledge and practice toward high risk neonate undergoing surgery regarding total parenteral nutrition and their demographic data.

Subject and Method

Research Design

Quasi experimental research design (pre-posttest) was utilized in this study.

Setting

This study was conducted in the Neonatal intensive care unit (NICU) at Minia university hospital for obstetric and pediatric (MUHOP).

Sample

A convenient sample (45nurses) including all nurses working in neonatal intensive care unit at Minia university hospital for obstetric and pediatric (MUHOP).

Data collection tools

Two tools were used for data collection:

Tool (I): Structured interview questionnaire: this tool was developed by **(Abo Atia et al., 2022)** and was modified by the researcher based on pertinent literature **(Hussien &Sayed., 2021), (Saeedi et al., 2022) a**nd was filled by nurse, It was included the following parts:

Part (1): Demographic characteristics for nurses: which included; Nurses' age, gender, educational level, years of experiences, and attendance of previous training programs about TPN.

Part (2): Nurses' knowledge questionnaire: It was true and false questions designed to assess nurses' knowledge regarding Total Parenteral Nutrition and its care which were classified into categories; as general knowledge, types, indications, contraindications, precautions during preparation, complications and management complications.

Scoring system: each question score ranged from 0 to 1 (correct answer=1 and incorrect answer= 0).These scores was summed and converted into a percent score. The level of nurses' knowledge was classified into:

- Satisfactory knowledge: ≥ 85%
- Unsatisfactory knowledge: <85%. According to: **(Abo Atia et al., 2022)**

Tool (II): Nurses' practices regarding administration of TPN (observational checklist): This is adopted from **Canberra Hospital and Health Services Clinical Procedure (2020)** about how to care of high risk neonates undergoing TPN. Such as preparation for administration (TPN), administration of TPN, nursing care after administration (TPN), cannulation and hand washing. **Scoring system**

The nurses' answers were evaluated using a model answer prepared by the researcher, and the correct answer was scored one while the incorrect answer/ don't know was scored zero. The scores of each area were summed up to give the total score; after that, the score was converted to a percent score, which was transferred into categories as follows: Satisfactory knowledge: ≥ 85.0% and Unsatisfactory knowledge: <85.0%. According to: **(Abo Atia et al., 2022).**

Ethical considerations

Research proposal was taken from the Ethical Committee in the Faculty of Nursing, Minia University (REC2023927A). And from the directors of intensive care unit (NICU), Minia University Hospital **.**There was no risk to the study subject during the application of the research. Confidentiality of subject data was assured. Participants had the right to refuse to participate and or withdraw from the study without any rationale at any time. Participants' privacy and anonymity was considered during the collection of data.

An official letter was granted from the research ethics committee of the Faculty of Nursing, Minia University. Approval to conduct the study was obtained from the dean of the Faculty of Nursing at Minia University. Permission and consent was obtained from the director of the hospital and nursing directors. Permission and consent was obtained from the head of the department and the head nurse.

Before the conduction of the pilot study as well as the actual study, consent was obtained from the participants who were willing to participate in the study after explaining the nature and purpose of the study. Participants had the right to refuse to participate or withdraw from the study without any rationale at any time. Participant's privacy was considered during the collection of data. Participants ensured that all their data are highly

confidential; anonymity was also being assured by assigning a number for each nurse instead of names to protect their privacy.

Validity and reliability

The tools' validity was tested through a jury of three experts in the field of pediatric nursing and two experts in the field of pediatric surgery**.** Their opinions on the tool format layout, consistency, knowledge accuracy, relevance, and competence was formulated. Some modifications were applied according to their opinions.

Reliability

To establish reliability alpha as Cronbach's alpha coefficient, statistical analysis was used to check the stability of the internal consistency of the tools. Cronbach's alpha coefficient of 0.00 indicated no reliability, and a coefficient of 1.00 indicates perfect reliability. Reliability of tools was done using a coefficient test to confirm its consistency.

Pilot study

A pilot study was conducted on 5 of the studied nurses (10%) to assess the study tools for their clarity, validity, and time required to be applied. According to the results of the pilot study, no modifications made. Pilot study was included in the main study sample.

Procedure of data collection:

The researcher reviewed current and previous, local and international related literature and theoretical knowledge of various aspects of the study using books, articles, journals, and internet to prepare the tools of data collection, and then determine suitable time to collect the data and confirm days and times suitable to conduct the study. After that, the researcher met the study subjects and arranged with them for completing the study tools. The program was conducted over a period of three months from the beginning of April to the end of June 2024

The clinical guidelines program:

The proposed program was conducted through the following phases:

1- Assessment phase

This assessment aimed to evaluate nurses' baseline knowledge, clinical competencies, and educational gaps about the topics to be covered in the program. The researcher visited the previously mentioned study setting two days/a week, introduced herself, and explained the study aim. The expected outcomes were explained for the nurses. Each nurse was interviewed individually after obtaining informal consent to contribute to the study; they enhance cooperatively to participate. The investigator collected the demographic data and assesses nurses' knowledge about TPN (Tool I). On the same time, the investigator observed the nurses' practices during their work by observational checklist (tool II).

2-Planning:

The planning phase included the nursing program time, number of sessions, teaching methods, and media used. In addition, the teaching place and the program facilities were checked for appropriateness. Nurses were divided into small groups (9-11 groups); each group contains 4-5 nurses. The number of sessions was five sessions/group; so ten sessions every week for the study group.

Program teaching methods:

The researcher used different teaching methods during the implementation of the educational program. It included lectures, group discussions, demonstration and re-demonstration, and various teaching media such as watching videos, power point presentations, and handouts about TPN.

3-Implementation phase

The nursing program implementation was premeditated based on the actual nurses' needed assessment of the nurses through reviewing the related literature. Implementing the educational program covered the theoretical and practical skills regarding total parenteral nutrition for high risk neonate undergoing surgery. Nurses were divided into small groups (9 groups); each group contains 4-5 nurses and the same nursing program was implemented for each group of nurses.

The program content was as follows:

Through five session's theoretical and practical sessions, the researcher started every session with a summary related to previous sessions and the objectives of the new session.

1st session: Involves information about definition, types, components, indications, and risk factors of TPN.

2nd session: Involve information about complications, prevention of complications and contraindications of TPN.

3rd session: Involve hand washing procedure and cannulation.

4th session: Practical demonstration about TPN (Checklist of TPN for high risk neonate undergoing surgery).

5th session: Involves revision for theoretical and practical part of program.

4-Evaluation phase

Pre- test evaluation was performed by using tool I & II to determine need and weak point in nurses' performance and after one month from ending the program by using tool I part two and tool II to evaluate the program effectiveness

Data analysis:

The collected data were tabulated & statistically analyzed using a software program and statistical package for social science (SPSS 25.0). The statistical analysis included percentage (%), mean, and stander deviation (SD). Chisqura test is used to detect differences between more than two variables, and the sample size is small. Graphs were done for data visualization using Microsoft Excel. A correlation test and P - value of ≤ 0.05 indicates a significant result, while a P value > 0.05 indicates a non-significant result.

Results

Table (1) Socio-demographic characteristics of the studied nurses (n=45):

Socio demographic data	N	%
Age / years		
19-29 yrs.	36	80.0
30-39yrs.	6	13
40-49yrs.	3	7
40 - >54yrs.	0	0.00
Mean ± SD	27.10 ± 5.1	
Sex		
Male	8	18
Female	37	82
Level of Education		
Secondary nursing diploma	3	7
Technical institute of nursing	36	80
Bachelor of sciences in nursing	6	13
Postgraduate studies	0	0.00
Years of Experiences		
Less than 5years	27	60.0
6-10years	12	27
10years and more	6	13
Mean ± SD	5.25± 5.13	
Training courses		
Yes	18	40.0
No	27	60.0
If yes		
In hospitals	15	33
Out of hospitals	3	7

NS= Not statistically significant differences

Table (1) : shows the distribution of nurses' according to their socio-demographic characteristics. It was found that most of nurses' age (80%) ranged from 19 to 29 years with a mean 27.10 ± 5.1 years. As for the nurses' sex it was shown that (82.2%) were female. As regards their qualification most of nurses' having Technical institute of nursing (80.0%), as for nurses' years of experience, it was noticed that (60.0%) of nurses who having work experience less than 5 years, with a mean 5.25 ± 5.13 years. Regarding training courses, it was noticed that (60.0 %) of nurses' who didn't attending training courses about total parenteral nutrition for high risk neonate undergoing surgery.

Table (2) Distribution of nurses' according to their pre and post-test general knowledge about TPN (n=45)

General knowledge of nurses about TPN	Test pre		Test post		P. value
	No	%	No	%	
TPN is a form of treatment					X2=50.22 0.21
Yes	35	78	45	100	
No	10	22	0	0.00	
TPN is a form of nutrition that is given intravenously.					X2=54.15 0.26
Yes	37	82	43	96	
No	8	18	2	4	
TPN is a form of nutrition that is given intravenously.					X2=53.12 0.46
Yes	45	100	45	100	
No	0	0.00	0	0.00	
TPN can be given at home.					X2=50.16 0.05*
Yes	5	11	38	85	
No	40	89	7	15	
It is preferable to use TPN rather than enteral nutrition.					X2=52.15 0.45
Yes	14	31	45	100	
No	31	69	0	0.00	
TPN is used when it is the only source of nutrition					
Yes	13	29	37	82	X2=42.12 0.32
No	32	71	8	18	
Total scores of nurses general knowledge about TPN					
Satisfactory knowledge	12	27	45	100	X2=33.32 0.02*
Unsatisfactory knowledge	33	73	0	0.00	

*statistical significance difference

Table (2) illustrates the distribution of nurses' according to their pre and post-test general knowledge about TPN. It was found that 89% of nurses had no knowledge in pre-test about TPN can be given at home while in post-test 85% of nurses had knowledge with statistically significance (P.0.05). Related to total scores of nurses general knowledge about TPN 73% of nurses had unsatisfactory knowledge in pre-test while in post-test 100% of nurses had satisfactory knowledge. This raise in nurse's knowledge in post-test than pre-test reached statistically significant difference (P.0.02).

Table (3) Distribution of nurses' according to their pre and post-test knowledge about uses of TPN (n=45)

knowledge about uses of TPN	Test pre		Test post		P. value
	No	%	No	%	
Neonate who weight at birth more than 1500gm and nothing per-mouth more than 3 days					X2=60.14 0.24
Yes	28	62	45	100	
No	17	38	0	0.00	
Neonates who diagnosis is stomach inflammation					X2=44.10 0.04*
Yes	12	27	45	100	
No	33	73	0	0.00	
Post-operative neonates who cannot have breastfeeding for long time					X2=30.12 0.56
Yes	45	100	45	100	
No	0	0.00	0	0.00	

*statistical significance difference

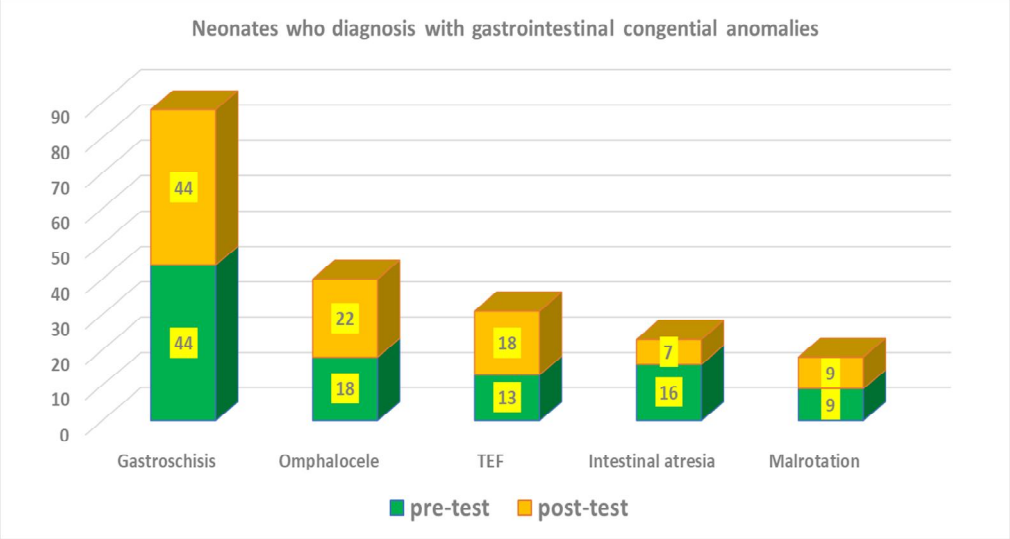

Fig.(1): Percent distribution of neonates who diagnosis with gastrointestinal congenital anomalies

Table (3) & Fig (1): reveals that, 73% on nurses had no knowledge about Neonates who diagnosis is stomach inflammation while in post-test 100% of nurses had knowledge (P.0.04). 44% of neonates who diagnoses with gastrointestinal congenital anomalies were have gastroschisis in pre and post-test (P.0.05).

Table (4) Distribution of nurses' according to their pre and post- knowledge about contraindication and preparation of TPN (n=45)

Nurses knowledge about contraindication and preparation of TPN	Pre-test		Post-test		X2 P. value
	No	%	N	%	
Severe high blood sugar levels.					X2=0.45 0.02*
Yes	21	47	40	89	
No	24	53	5	11	
For a long period of time.					X2=0.60 0.04*
Yes	19	42	42	93	
No	26	58	3	7	
Total of nurses knowledge about contraindication of TPN					X2=0.53 0.01*
Satisfactory knowledge	14	31	43	96	
Unsatisfactory knowledge	31	69	2	4	
Nurses knowledge about prepare of TPN					
Calories in nutraceutical solutions are provided primarily by carbohydrates and fats.					
Yes	16	36	35	78	X2=0.66 0.34
No	29	64	10	22	
Glucose must be supplied to maintain normal plasma glucose levels and to meet the demand for glucose utilization.					X2=0.36 0.03*
Yes	12	27	38	84	
No	33	73	7	16	
Sodium and potassium concentrations are adjusted daily based on individual requirements.					X2=0.33 0.012*
Yes	18	40	42	93	
No	27	60	3	7	
Water and fat-soluble vitamins are added as a multivitamin solution for children.					X2=0.56 0.025*
Yes	15	33	40	89	
No	30	67	5	11	
Zinc is recommended from the first day of PN, while other elements are generally provided after two weeks.					X2=0.48 0.032*
Yes	12	27	37	82	
No	33	73	8	18	
Total scores of nurses knowledge about preparations of TPN					X2=0.56 0.02*
Satisfactory knowledge	12	27	40	89	
Unsatisfactory knowledge	33	73	5	11	

*statistical significance difference

Table (4): shows that, 69% of nurses had unsatisfactory knowledge about contraindication in pre-test while in post-test was 96% of nurses had satisfactory knowledge (P.0.01). 73% of nurses had unsatisfactory knowledge in pre-test while in post-test was 89% of nurses had satisfactory knowledge about total score of nurses knowledge about preparations of TPN (P.0.02)

Table (5) Distribution of nurses' according to their pre and post-test practices about Preparation of TPN (n=45)

Practices about preparation of TPN	Test pre		Test post		P. value
	No	%	No	%	
Attend hand hygiene.					X2=35.32 0.21
Done	12	27	34	76	
Not done	33	73	11	24	
Clean dressing trolley					X2=42.20 0.012*
Done	0	0.00	38	84	
Not done	45	100	7	16	
Collect equipment					X2=53.25 0.123
Done	45	100	45	100	
Not done	0	0.00	0	0.00	
Remove TPN from refrigerator and place on trolley					X2=45.16 0.453
Done	45	100	45	100	
Not done	0	0.00	0	0.00	
Check TPN prescription order against the prepared TPN					X2=32.16 0.762
Done	45	100	45	100	
Not done	0	0.00	0	0.00	
Attend hand hygiene					
Done	14	31	40	89	X2=54.11 0.032*
Not done	31	69	5	11	
Attend patient identification check with second staff member					
Done	0	0.00	36	80	X2=43.17 0.024*
Not done	45	100	9	20	
Total of nurses practices about preparation of TPN					
Competent	28	62	42	93	X2=56.24 0.034*
Incompetent	17	37	3	7	

*statistical significance difference

Table (5): reveals that, 100 % of nurses not done attend patient identification check with second staff member in pre-test, while in post-test 80% of nurses done in post-test (P.0.02). Related to nurses practices about preparation of TPN there were37 % of nurses had incompetent practices in pre-test, while 93% of nurses had competent practices. This improves in nurses practices in post-test than pre-test reached statistically significant difference (P.0.034).

Table (6) Distribution of nurses' according to their pre and post-test practices about administration of TPN (n=45)

Practices about administration of TPN	Test pre		Test post		P. value
	No	%	No	%	
Roll up light protective cover to allow access to TPN access port					X2=55.18 0.234
Done	45	100	45	100	
Not done	0	0.00	0	0.00	
Attend hand hygiene					X2=45.18 0.051*
Done	12	27	38	84	
Not done	33	73	7	16	
Apply clean nonsterile gloves					X2=53.14 0.052*
Done	14	31	40	89	
Not done	31	69	5	11	
Access insertion port on TPN bag by removing blue tab					X2=44.16 0.231
Done	45	100	45	100	
Not done	0	0.00	0	0.00	
Swab insertion port on TPN bag vigorously with chlorhexidine 2% alcohol 70% swab for 10 seconds					X2=52.17 0.025*
Done	0	0.00	42	93	
Not done	45	100	3	7	

Practices about administration of TPN	Test pre		Test post		P. value
	No	%	No	%	
Hang the bag on the intravenous pole and re-apply light protect cover					
Done	45	100	45	100	X2=54.12 0.323
Not done	0	0.00	0	0.00	
Label IV line					
Done	45	100	45	100	X2=34.10 0.247
Not done	0	0.00	0	0.00	
Insert line in IV pump and use machine to prime line					X2=45.13 0.250
Done	45	100	45	100	
Not done	0	0.00	0	0.00	
Select the TPN setting on the infusion pump					X2=54.02 0.861
Done	45	100	45	100	
Not done	0	0.00	0	0.00	
Total of nurses practices about administration of TPN					
Competent	35	78	45	100	X2=64.43 0.342
Incompetent	10	22	0	0.00	

*statistical significance difference

Table (6): clarifies that, there were no statistically significant between pre-test and post -test in roll up light protective cover to allow access to TPN access port, access insertion port on TPN bag by removing blue tab, Hang the bag on the intravenous pole and re-apply light protect cover, label IV line, insert line in IV pump and use machine to prime line, select the TPN setting on the infusion pump, and total of nurses practices about administration of TPN at (p-value0.234, 0.231, 0.323, 0.247, 0.250, 0.342); respectively

Table (7): The correlation between the total scores of the nurses' knowledge and practice in pre and post-test about TPN (n=45)

Knowledge	Practice	
	Correlation Coefficient (r)	P. value
Pre-test	0.78	.001*
Post-test	0.87	.001*

*highly statistical significance difference

Table (7) shows the correlation between the total scores of nurses' knowledge and practice in pre and post-test. It is evident that the highest strong positive statistically significant correlation was found between the total scores of knowledge and practice of nurses who in post-test (r=0.87) and the lowest strong positive statistically significant correlation was found between the total scores of knowledge and practice of nurses in pre-test (r=0.78).

Discussion

Parenteral nutrition (PN) is a life-saving intervention for neonates 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 (**Berlana, 2022).**

Nurses are vital in managing TPN for high-risk surgical neonates. Key responsibilities include maintaining vascular access catheters and delivery systems, preparing/administering TPN solutions, performing site dressing changes, and regularly replacing infusion sets. Critical care nurses must be proficient in TPN delivery **(Faris & Abed, 2022).**

As for nurses' socio-demographic characteristics, in the current study it was found that most of nurses' age ranged from 19 to 29 years, female nurses represent the highest proportion in the sample, in addition, the highest percentage among them were graduated from technical institute of nursing.

From the researcher's perspective, the rise in the proportion of nursing technical institute graduates is attributable to heightened demand for these institutions, as well as the fact that they are recent graduates with robust physical capabilities, enabling them to manage work demands; they

constitute a large percentage of nursing personnel inside hospitals. In addition, elevated percentage of female nurses may be attributed to nursing being a mostly female profession in Egypt.

Similarly, **MANAL et al. (2018)** conducted a study entitled "Assessment of Critical Care Nurse's Knowledge and Practices Regarding Care of Patients Receiving Total Parenteral Nutrition" revealed that, 60% of the studied samples were females. The age, more than one thirds of the studied subjects 43.3% were ranged between 20-29 years. As regards to educational level, most 51.7%, 35% of nurse's participants had technical nursing diploma degree and secondary nursing school degree, respectively. Also these results agree with **Hashem, (2024) and Al-Qalah & Alrubaiee, (2020)** who mentioned that more than half of the study participants were less than 30 years, graduated from technical institute of nursing and the highest percentage of them were females.

Furthermore, the study findings revealed that the highest percentage of studied nurses had a work experience less than 5 years. In the same line, **Abo Aita & Mahmoud, (2022)** conducted a study entitled "Assessment of Critical Care Nurses' Knowledge and Practice Regarding Care of Patients Undergoing Total Parenteral Nutrition" reported that educational level and years of experience, 52% of the studied nurses had technical institute of nursing but not consistent with this study related to years of experience, showed that 46% of them had 5-10 years of experiences.

As for nurses` knowledge regarding total parenteral nutrition for high risk neonate undergoing surgery, the current study found that the highest percentage of nurses had incorrect answer about giving TPN at home in pre-test, while the majority of them represents answered that item correctly at posttest. At the same line, **Abo Aita, Aboelfetoh & Mahmoud, (2022**) found that nurses need to have a comprehensive understanding of TPN to ensure safe and effective home care for neonate.

Related to total scores of nurses' general knowledge about TPN, the majority of nurses had unsatisfactory knowledge in pre-test while in post-test all of them had satisfactory knowledge with statistically significant difference. From the researcher point of view, this improvement could be regarded to the positive effect of the implemented educational program on enhancing nurse's knowledge

Many studies supported our result, **El-Morsy et al. (2020)** applied a study entitled "The Effect of Implementing a Guideline Protocol on Nurses' Knowledge about the Nutritional Requirements of Low Birth- Weight Infants" and found that, more than half of the studied nurses had insufficient knowledge about nutritional requirements of low birth weight infants, pre implementation of guideline protocol, while, all of the studied nurses had a sufficient knowledge post implementation of guideline protocol.

As for nurses` knowledge regarding total parenteral nutrition for high risk neonate undergoing surgery, the current study found that the highest percentage of nurses had incorrect answer about giving TPN at home in pre-test, while the majority of them represents answered that item correctly at posttest. At the same line, **Abo Aita, Aboelfetoh & Mahmoud, (2022**) found that nurses need to have a comprehensive understanding of TPN to ensure safe and effective home care for neonate.

Furthermore, a recent study conducted by **Sakran & Al-Mosawi, (2024**) found that the majority of nurses exhibited unsatisfactory knowledge levels in the pre-test phase. However, following an educational intervention, all nurses demonstrated satisfactory knowledge in the post-test phase. This change was statistically significant, indicating that the educational program effectively enhanced the nurses' understanding of TPN practices for neonates.

In relation to indication of parenteral nutrition, the current study revealed that the highest percentage of nurses knew that neonates stomach inflammation and gastrointestinal congenital anomalies are the most common indication for TPN. A recent study by (**Hussien, & Sayed, 2021**) has highlighted that a significant percentage of nurses are aware of total parenteral nutrition (TPN) indications and contraindication in neonates include stomach inflammation and gastrointestinal congenital anomalies. In addition, (**Sonone et al., 2021**) mentioned that TPN is often necessary for neonates with severe gastrointestinal issues, as it allows for the delivery of essential nutrients directly into the bloodstream, bypassing the digestive system.

Related to nurses'practices about preparation and administration of TPN, The intervention significantly improved overall nurse competency in TPN preparation (pre-test: 62% → post-test: 93%, *p*=0.034), demonstrating effective knowledge translation. Critical pre-intervention deficits were identified in **hand hygiene** (27% compliance), **trolley disinfection** (0%), and **patient**

ID verification (0%) – high-risk omissions, Post-intervention, these specific steps showed marked gains: hand hygiene (76%, *p*=0.032), trolley cleaning (84%, *p*=0.012), and ID verification (80%, *p*=0.024), the residual gaps in foundational aseptic steps – particularly hand hygiene (24% non-compliance post-test) – highlight the need for ongoing audits and feedback to sustain gains.

The studied nurses represents a competent practice in posttest evaluation compared to the pre-test, from the researcher perspectives, the transition from incompetent practices in the pre-test to a majority of competent practices in the post-test illustrates the vital role of education in nursing practice. Continuous professional development is crucial for maintaining high standards of care in TPN administration, ultimately enhancing patient safety and treatment efficacy.

In the same line, a study conducted by **Gaur and Natha, (2023**) highlighted that targeted educational initiatives significantly improved nursing competencies, leading to better adherence to clinical guidelines and protocols for TPN administration. Furthermore, (**Johnson et al. 2023**) found that regular training sessions not only increased knowledge but also fostered a culture of safety and accountability among nursing staff, which is essential in high-stakes environments like TPN administration.

The current study presented that there were no statistically significant differences between pre-test and post-test scores in several key steps related to total parenteral nutrition (TPN) administration practices. Specifically, nurses demonstrated no significant improvement in tasks such as rolling up the light protective cover to access the TPN port, accessing the insertion port on the TPN bag by removing the blue tab, hanging the bag on the intravenous (IV) pole and reapplying the light protective cover, labeling the IV line, inserting the line into the IV pump and priming it, as well as selecting the TPN setting on the infusion pump. The p-values for these steps ranged from 0.231 to 0.342, all exceeding the threshold for statistical significance (typically $p < 0.05$). These results suggest that the educational intervention or training provided may not have been sufficient to bring about a measurable improvement in these specific practical skills. It may also reflect the possibility that nurses already had a moderate or high level of competence in these procedures prior to the intervention, leaving little room for observable change. Further investigation into the content, duration, and delivery method of the training program is warranted to enhance its effectiveness in improving clinical practice.

Regarding correlation between studied variables, the study revealed a strong positive statistically significant correlation between the total scores of knowledge and practice of nurses concerning Total Parenteral Nutrition (TPN) in both the pre-test and post-test evaluations. This finding suggests that as nurses' knowledge about TPN increases, so does their ability to implement safe and effective practices in administering TPN. Such a correlation underscores the importance of education and training in bridging the gap between theoretical knowledge and practical application, a key component in ensuring patient safety and quality care.

Similarly, **Talat Ghoneim & Mohamed Said, (2023**) conducted a study entitled "Effect of Designed Nutritional Guidelines on Nurses' Performance regarding Feeding of Low Birth-Weight Infants. Journal of Nursing Science Benha University'' found a positive correlation and highly statistical significance between total knowledge and total practice scores at pre and post designed guidelines intervention phases.

In addition, **Ebrah et al. (2020)** in a study about "The effect of intervention on nurses performance regarding feeding of premature baby in neonate care unit at public hospitals in Hodeida city: Yemen " revealed that, there was a strong positive correlation between nurses' total knowledge and their total practice. Furthermore, **Hashem, (2024**) emphasized that targeted educational interventions lead to a significant enhancement in both the knowledge and practical skills of nurses, particularly in complex care situations like TPN administration.

Conclusion

Based on the findings of the current study, it can be concluded that, the findings of this study clearly demonstrate the significant positive impact of the educational program on nurses' knowledge and practice regarding total parenteral nutrition for high risk neonate undergoing surgery, as well as positive statistically significant correlation between total knowledge scores and total practices scores before and after one month of program.

Recommendations

Based on the results and conclusion of the current study, the following recommendations were suggested:

- New nursing staff in neonatal intensive care units (NICUs) should receive structured education on total parenteral nutrition for high risk neonate undergoing surgery during their orientation period.
- Implement continuous educational program and workshop about the evidence based guidelines on total parenteral nutrition for high risk neonate undergoing surgery targeting all nurses in all intensive care units in other hospitals.
- Develop Standardized Protocol should be present and reviewed regularly and updates in the intensive care units about the evidence based guidelines for total parenteral nutrition for high risk neonate undergoing surgery and learned to all nurses in NICUs.
- Periodical follow-up evaluation for the level of knowledge and practices of all nurses regarding total parenteral nutrition for high risk neonate undergoing surgery.

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