



THE EVOLUTION OF PEDIATRIC NURSING EDUCATION IN EGYPT

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Abstract: Background: Neonatal nurses form the cornerstone of neonatal care units, especially neonates' receiving parenteral nutrition. However, the application of this therapy requires a high degree of nurses' practice and knowledge. Several studies showed that nurses' performance regarding parenteral nutrition contributes significantly to the efficacy of this treatment. Aim of the study was to assess the impact of educational program on the performance of nurses in the area of parenteral nutrition.

Settings: The research was conducted at Benha University hospital's Neonatal Intensive Care Units. Design: To accomplish this study's objective, a quasi-experimental design was implemented. Methods: A purposive sample composed of all neonatal nurses. Tools: Two instruments were utilized to collect the data: a structured questionnaire sheet and an observational checklist.

Results: The age range of the nurses under study was 20–30 years on average, with the majority being female and less than one third attended training courses. After completing the educational program, the nurses' understanding of parenteral nutrition improved in a highly statistically significant way; the majority of them were able to provide accurate responses. A statistically significant correlation was seen between the nurses' overall understanding and implementation of parenteral nutrition procedures and specific variables, including age, academic credentials, years of experience in NICU, and attendance at training courses. A statistically significant positive association was seen between the overall knowledge of the nurses under study and their total practices, both before and after the intervention.

Conclusion: The majority of post-intervention nurses possessed adequate expertise. Furthermore, a substantial and statistically significant disparity in overall parenteral nutrition practice was seen between the period before and after the intervention. A significant proportion of the nurses possessed proficient **post-intervention skills**.

Recommendation: Continue applying similar educational programs to ensure that the nurses have update knowledge and skills in neonatal parenteral nutrition.

Keywords: Nurses, Performance, parenteral nutrition, neonatal intensive care units.

INTRODUCTION

Parenteral nutrition (PN) is a lifesaving intervention that is used when enteral feeding is not possible or insufficient for neonate in neonatal intensive care units (NICUs). Also is estimated that up to 80% of NICU neonates receive PN during hospitalization. However, PN administration requires strict monitoring and knowledge, as can lead to serious complications such as bloodstream infections, electrolyte imbalances, and metabolic disorders. Thus,

trained healthcare professionals are needed to ensure safe and effective PN administration to neonates (Jolley & Shields, 2020).

The administration of parenteral nutrition in NICU is a complex and critical process that requires specialized knowledge and skills. Proper administration of parenteral nutrition is vital for growth and development of premature neonates and errors or complications during this process can have serious consequences (Nantsupawat et al., 2021).

Parenteral nutrition, which delivers nutrients straight to the circulation and skips the digestive tract, is necessary for neonates who cannot be adequately nourished orally or through a feeding tube (enterally). An infusion of a sterile fluid containing vital nutrients is administered intravenously to the newborn. Parenteral nutrition is often used as a bridge until enteral feedings are established. Most neonates born before 30 weeks and many born before 32 weeks of gestation (very or extreme preterm neonates) require at least some PN during the first days or sometimes even weeks of life until full enteral feeding is tolerated (*Abdelhadi et al., 2022*).

In the NICU, neonatal nurses provide essential care for infants who are undergoing parenteral nourishment. The responsibilities include ensuring the safe and accurate administration of parenteral nutrition, monitoring the neonate's response to the therapy, educating parents about the therapy and participating in the development of protocols for the administration of parenteral nutrition. With specialized knowledge and expertise, neonatal nurses are critical members of the healthcare team caring for neonates in the NICU (*Kintu et al., 2021*).

Significance of the study:

The prevalence of warts was 10.3% among primary school children in Tema, a mixed rural-urban area of Upper Egypt. Common wart was the most common type, and the hand was the most affected site. Significant predictors were big family size and sharing shoes with other family members. Other significant associated factors included living in rural areas, belonging to public the prevalence of warts was 10.3% among primary school children in Tema, a mixed rural-urban area of Upper Egypt. Common wart was the most common type, and the hand was the most affected site. Significant predictors were big family size and sharing shoes with other family members. Other significant associated factors included living in rural areas, belonging to public the prevalence of warts was 10.3% among primary the prevalence of warts was 10.3% among primary the prevalence of warts was 10.3% among primary the prevalence of warts was 10.3% among primary

In Egypt, preterm birth constitutes an estimated 10% of the overall number of live births (*Abdelhady & Abdelwahid., 2015*). Additionally, issues related to preterm birth account for around 28.5% of all fatalities among children aged below 5 years in Egypt. Egypt secured the 144th worst position among 162 nations in terms of prematurity-related fatalities (*Fala, et al., 2014*).

In the NICU, infants primarily require appropriate nutritional care. PN administration usually satisfies these requirements, particularly in the early phases of life. In order to prevent errors, the expertise and knowledge of the nurses administering this therapy are two crucial components. Successful parenteral nutrition therapy necessitates the implementation of suitable nursing care and meticulous biochemical monitoring. Additionally, suitable clinical standards for the relative proportions of parenteral nutrition solution components ensure that newborns receive enough nutritional support and are protected from any dangers associated with PN therapy. (*Deshpande et al., 2020*)

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The purpose of this research was to assess the impact of an instructional programme on the performance of nurses in NICUs with regard to parenteral nutrition:

The objective of this research was achieved through the following:

Assessing nurses' knowledge and practice concerning parenteral nutrition.

Design and execute an instructional curriculum pertaining to parenteral nutrition for nurses.

Assess the impact of an educational program on the development of nurses' understanding and use of parenteral nutrition. **Research Hypothesis:**

H₁: Evaluate the effect that an educational program has on the growth and application of nurses' knowledge and skills about parenteral feeding.

H₂: Regarding TPN, there will be a significant link between the entire knowledge and practices of the nurses under study.

H₃: A significant association will exist between the attributes of the nurses under study and their overall knowledge and practices.

2. SUBJECTS AND METHOD

Research design: Descriptive research design was utilized in this research.

Setting: The research was conducted at the Neonatal Intensive Care Units (NICUs) of Benha University hospital, which were partitioned into four distinct units: critical condition unit, mild condition unit, stable condition unit, and surgical care unit.

Sampling: A purposive sample was selected, consisting of seventy neonatal nurses, irrespective of age, gender, credentials, or years of experience, who were employed at the aforementioned locations at the time the study commenced.

Inclusion criteria: Nurses working at the previously mentioned setting. Nurses' age ranged from 20 – 40 years.

Exclusion criteria:

Nurses who had less than a year of experience providing parenteral nourishment for neonates were ineligible to participate in the research.

Tools of data collection: Data was gathered utilizing the subsequent tools:

Two tools were utilized for this research:

Tool I: A Pre- designed Structured Interviewing Questionnaire Sheet:

The researcher formulated the plan subsequent to conducting a comprehensive evaluation of the pertinent literature, which was subsequently approved by the supervisors. It was composed in Arabic in order to collect information regarding the following sections:

Part I: Nurses' characteristics including gender, age, residence, qualifications, years of experience and previous attending a training course.

Part II: Neonatal characteristics including gestational age, recent weight, birth weight, and chronological age.

Part III: Neonatal nurses' knowledge regarding total parenteral nutrition.

It was compiled by a researcher utilizing pertinent literature **Bolisetty et al., (2020) and Zhao et al., (2020)**. It included 20 closed questions (10 questions in true or false form and 10 questions in MCQ form). The true or false questions such as nursing care during parenteral nutrition includes measuring neonatal weight per day at first and then 2 to 3 times a week, the nurse should change the peripheral cannula used to administer parenteral nutrition every 48 hours and input and output fluids should be mapped when parenteral nutrition is given every 24 hours. Also, MCQ questions such as blood sugar in neonates receiving parenteral nutrition should be monitored within the first 48 hours every day and indication of parenteral nutrition for neonate.

Scoring system:

The nurses' knowledge was assessed using a model key answer; the correct response received a score of 1, while any erroneous or unknown response received a score of zero. The cumulative score was then expressed as a percentage. It was divided into the following two categories:

- Satisfactory knowledge if score $\geq 75\%$ equal score ≥ 15 degree.
- Unsatisfactory knowledge if less than 75% equal < 15 degree.

Tool II: Observation Checklists: The checklists utilized for evaluating the practices of nurses concerning TPN such as TPN which adopted from Parthik *et al.*, (2021) and included (37 steps), hand washing which adopted from Avsar *et al.*, (2015) and included (10 steps), Alcohol based which adopted from Tan *et al.*, (2020) and included (9 steps), aseptic gowning which adopted from Baseman., (2020) and included (12 steps), put on sterile gloves which adopted from Ashtekar., (2021) and included (12 steps), Cannula insertion which adopted from Morgaonkar *et al.*, (2017) and included (14 steps), and avoidance of a central venous catheter (CVC) infection which adopted from Salama *et al.*, (2016) and included (12 steps) **Scoring system:**

The overall score was 106; things that were deemed "done" received one point; those that were deemed "not done" received zero points. The aggregate of these scores was utilized to get the percentage score. It was divided into two distinct categories:

- Competent practices: if score $\geq 80\%$. (85 – 106)
- Incompetent practices: if score $< 80\%$. (0 – 84)

II. Operational Design:

The operational design was including:

preparatory phase, content validity, ethical considerations, pilot study and fieldwork.

Preparatory Phase:

In order to construct data collection instruments, this phase entailed a review of pertinent literature and theoretical understanding of many facets of the study, as well as the examination of periodicals, books, articles, websites, and magazines. This facilitated the development of the research instruments utilized for data collecting. The researcher visited the designated locations during this phase in order to become acquainted with the personnel and study environments. The tools were evaluated with the input of specialists and under the supervision of supervisors.

Tools validity:

In order to verify the clarity, comprehensiveness, relevance, understanding, applicability, and validity of the tools, a panel of three paediatric nursing specialists examined them. In order to evaluate the degree to which a measurement encompasses all facets of the construct being assessed and the measure's conformity to established theory and understanding of the construct, it was determined how the measure was established (content).

Tool's reliability:

The reliability of the tools was assessed utilizing the coronach alpha test, which examined the consistency of outcomes across time, among various observers, and across sections of the test.

Tool	Cronbach score	Estimated
Knowledge	0.824	Good reliability
Practices	0.906	Excellent reliability

Ethical Considerations

The study received ethical approval from the Ethical Research Scientific Committee of Helwan University's Faculty of Nursing. Then, the medical and nursing directors of the neonatal intensive care units at Banha University Hospital granted permission for this research to be conducted. Additionally, the agreement of oral

nurses to partake in this research was sought. The confidentiality and anonymity of the research subject were ensured. Nurses were duly told that all data collected would be utilised solely for research purposes, that the trial was completely risk-free, and that participants were able to withdraw from the research at any point.

Pilot Study:

A pilot study was conducted on seven neonatal nurses at the NICU, constituting 10 % of the projected sample size. The purpose of this study was to assess the clarity of the included questions and the suitability of the created instruments in relation to the knowledge and practice of nurses. In addition, the pilot study determined the approximate duration required for each participant to complete the survey. As a consequence of the absence of item adjustments or omissions as determined by the pilot results, the nurses were incorporated into the study sample and included in the pilot study.

Field work:

Helwan University's Faculty of Nursing granted its approval. Then, the medical and nursing directors of the neonatal intensive care units at Banha University Hospital granted permission for this research to be conducted. The purpose of the study was elucidated with the intention of securing consent and collaboration. The researcher trained nurses that providing care for studied neonates about technique of clustering nursing care and creating healing environment through on job training. Data collection was taken eight months commenced with the initial of March 2022 to the end of October 2022. The researcher required approximately 30 to 45 minutes to complete the checklist evaluating nurses' practise with regard to neonatal parenteral nutrition, whereas each nurse completed the questionnaire in approximately 15 to 20 minutes.

Assessment of nurses (Pre):

The researcher briefed the examined nurses on the purpose of the study and the constituent elements of the instruments.

The researcher administered a questionnaire to the nurses under study in order to evaluate their knowledge, and subsequently monitored their behaviors in relation to total parenteral nutrition using a previously developed checklist. Preparing and designing the educational programme in accordance with the nurse's needs and pre-test results.

Planning phase:

By utilizing books, periodical articles, and the research network, pertinent literature that addresses the many facets of the study was consulted in conjunction with baseline data acquired during the assessment phase (i.e., the evaluation of nurses). The researcher developed the educational program in response to the requirements of the nurses. It was developed and amended in light of pertinent literature in order to enhance the performance of nurses with respect to parenteral nutrition.

Implementation phase:

The curriculum was divided into 6 sessions, with each lasting between 30 and 45 minutes: two for the theoretical portion and four for the practical portion. The nurses were duly informed of the training location and time. The researcher was visiting the study setting 3 days / week (Sunday, Wednesday & Thursday) from 10 a.m. to 11 a.m.

The Training Program:

After conducting a literature analysis, the researchers devised the nursing training program with the objective of enhancing the knowledge and practices of nurses in regards to TPN.

The training program's content:

Session 1: Introduction to Total Parenteral Nutrition (TPN):

Objectives:

1. Understand the importance of TPN at NICU.

2. Recognize indications for TPN in neonates.
3. Identify components of TPN and roles.

Content:

1. Introduction to the training program and objectives.
2. Overview of TPN and significance at NICU.
3. Indications for TPN in neonates.
4. Components of TPN: macronutrients, micronutrients, electrolytes, vitamins and trace elements.
5. Role of TPN in promoting growth and development in premature and critically ill neonates.

Session 2: TPN Administration and Monitoring:**Objectives:**

1. Learn the steps involved in preparing and administering TPN.
2. Understand the importance of accurate monitoring and assessment of TPN.
3. Identify potential complications and management.

Content:

1. Recap of Session 1 and brief overview.
2. Preparation and administration of TPN: a step-by-step guide.
3. Proper handling and storage of TPN solutions.
4. Monitoring and assessment of TPN: fluid balance, electrolyte levels, blood glucose and nutritional status.
5. Early detection and management of TPN-related complications (infection and metabolic disturbances).

Three Practical Session: TPN Preparation and Simulation Session 3: TPN Safety protocols, preparation and components:**Objective:**

By this session's conclusion, participants ought should be capable of:

1. Understand the basic concepts of TPN.
2. The essential safety protocols associated with TPN preparation and administration.
3. Able to accurately prepare TPN solutions.
4. Understand the various components and their functions.
5. Adhere to aseptic techniques throughout the process.

Session 4: TPN administration, monitoring and management process: Objective: After this session, the nurses should be able to:

1. Capable of safely administering TPN to neonates.
2. Monitor for potential complications.
3. Demonstrate the knowledge required to adjust TPN infusions based on neonatal needs.

Session 5: Hand washing techniques and Hand Rub with Alcohol Objective: By the end of this session, neonatal nurses Capable of utilizing hand washing steps with aseptic technique which reduce of infection.

Session 6: Proper glove and gown usage and IV cannulation

Objective: By the end of this session, neonatal nurses having the ability to:

1. Describe the correct procedures for donning and doffing gloves and gowns.
2. Demonstrate proper aseptic technique during IV cannulation.
3. Safely handle and dispose of sharps and biomedical waste.

Content:

1. Demonstration and practice of aseptic techniques in TPN preparation.

2. Role-play scenarios involving TPN administration and monitoring.
3. Simulation of TPN-related complications and appropriate management.
4. Calculations for individualized TPN orders.
5. Preparation of TPN solutions aseptically.
6. Proper storage and labeling of TPN bag
7. TPN administration techniques and equipment.
8. Calculating TPN infusion rates based on patient needs.
9. Monitoring for complications and side effects during TPN administration.
10. Hand Hygiene Techniques
11. Proper handwashing steps and duration.
12. Hand sanitizer use and when it's appropriate.
13. Demonstration and hands-on practice
14. Step-by-step demonstration and practice of donning and doffing gloves and gowns.
15. IV cannulation demonstration and hands-on practice with mannequins

Method of teaching and media used:

The researcher employed a variety of pedagogical approaches, including demonstration, group discussion, brainstorming, and reflective thought.

Evaluation phase for nurses (Post):

After the implementation the content of program, asked nurses for any questions and feedback, open discussion. Then asked nurses to complete posttest questionnaire and assessed observation checklist by the same tool used at pre intervention.

Administrative Design:

An official permission was obtained from Dean from the Dean of the Faculty of Nursing at Banha University Hospital at Helwan University. In order to secure authorization and collaboration, the researchers disclosed the techniques of data collecting and the objective of the study during a meeting with the hospital director.

Statistical Analysis:

Statistical Package for the Social Sciences was utilized to input the encoded data. (SPSS) (SPSS Inc; version 24; IBM Corp., Armonk, NY, USA). Once data entry was complete, an examination of the information was conducted in order to identify any errors. Then, the data was evaluated using the identical program that generates frequency tables with percentages. The qualitative data were expressed as percentages and numbers. In addition, where applicable, quantitative data were expressed as the mean or standard deviation. Chi-squared probability distribution is an invaluable tool when it comes to the analysis of categorical variables. T-test is an inferential statistic that is employed to ascertain whether a difference in means between two groups is statistically significant. A statistical measure of the strength of a linear link between two variables, the correlation coefficient quantifies this relationship. Statistical significance was ascribed to the results when $P \leq 0.05$, highly significant when $P < 0.01^{**}$, and non-significant when $P > 0.05$.

3. RESULTS

Table (1) indicates that, the studied nurses' mean age was $x - SD$. 29.4 ± 2.45 years and majority (84.3 %) of them were female. As regard residence, about three quarters (74.3 %) of the studied nurses resided in rural residence. Regarding academic qualifications, a majority of them (57.1%) held a bachelor's degree in nursing, whilst a minority (22.9 %) had completed health technical institute. Furthermore, a mere 31.4 % of the participants reported attending training courses specifically designed for newborns undergoing parenteral feeding.

This figure (1) indicates that a minority of the nurses surveyed (41.5 percent) possessed between five and ten years of experience in neonatal intensive care. Of the remaining 31.4 percent, less than one-third had less than five years of experience, and over one-quarter (27.1%) had more than ten years of experience.

Table (2) demonstrates that, over half (57.1 %) of the neonates examined had chronological age from 10 to less than 28 days while more than one third (34.3%) of neonates had from 1 to less than 10 days. Regarding gestational age, more than three quarters (77.1%) of neonates had less than 37 weeks, while less than one quarter (21.5%) of them had from 37 to 42 weeks. Moreover, more than two thirds (67.1%) of them were females. With respect to birth weight, more than three quarters (78.6%) of them were from 2.000 < 3.500 kg while less than one fifth (14.3%) of them were from 1.500 < 2.000 kg. As regard recent weight, majority (82.9%) of them were from 2.000 < 3.500 kg.

Table (3) specifies that fewer than half of the nurses who were examined (45.7%, 41.4%, 44.3% & 45.7%) have correct knowledge regarding items (Parenteral nutrition is giving the neonate what need of nutrients in the form of glucose, amino acids and fats only, calcium can be administered in the same vein used for parenteral nutrition, nurses can add medication to the bottle of parenteral nutrition solution and not necessary to cover the bottle of parenteral nutrition solutions during preparation or administration) at pre- intervention respectively, that progressed to most of them (91.4%, 82.9%, 84.3% & 98.6%) at post intervention had correct answer, respectively. Furthermore, a substantial statistically significant disparity in the knowledge of the examined nurses was observed before and after the intervention ($P < 0.001$).

Table (4) and Figure (2) demonstrates that a majority of the nurses surveyed (87.1 %) had satisfactory knowledge of parenteral nutrition and nursing care by the time the intervention began, compared to the majority (51.4 %) who had satisfactory knowledge before to the intervention. In addition, there was a statistically significant difference in the total knowledge of the nurses regarding parenteral nutrition and nursing care between before and after the intervention ($X^2 = 21.032$ at $p = 0.000$).

Table (5) and figure (3) demonstrates that there was a highly statistically significant difference ($p = 0.000$) between the whole practice of the examined nurses regarding parenteral nutrition nursing care before and after the intervention. Additionally, a majority of them (92.9 %) demonstrated competent practice prior to intervention, whereas over two-thirds (70 percent) demonstrated competent practice after intervention.

Table (6) demonstrated that a statistically significant positive link existed between the overall knowledge of the nurses under study and their total practices before and after the intervention as ($r = 0.527$ at $p = 0.005$) and as ($r = 0.763$ at $p = 0.000$), respectively.

Table (1): Frequency distribution of studied nurses' regarding their demographic characteristics (n=43).

Table (1): Number and percentage distribution of the studied nurses according to personal characteristics (n=70).

Items	No.	%
Age (Year)		
20 < 30	39	55.7
30 ≤ 40	31	44.3
X±S.D 29.4±2.45		
Gender		
Male	11	15.7
Female	59	84.3
Academic qualification		
Diploma of Nursing	9	12.9

Diploma of Nursing + specialization	5	7.1
Health Technical Institute	40	57.1
Bachelor of Nursing	16	22.9
Residence		
Rural	52	74.3
Urban	18	25.7
Attended training courses on the care of neonates receiving parenteral nutrition		
Yes	22	31.4
No	48	68.6

Figure (1): Percentage distribution of the studied nurses according to their years of experience in the Neonatal Intensive Care Unit (n=70).

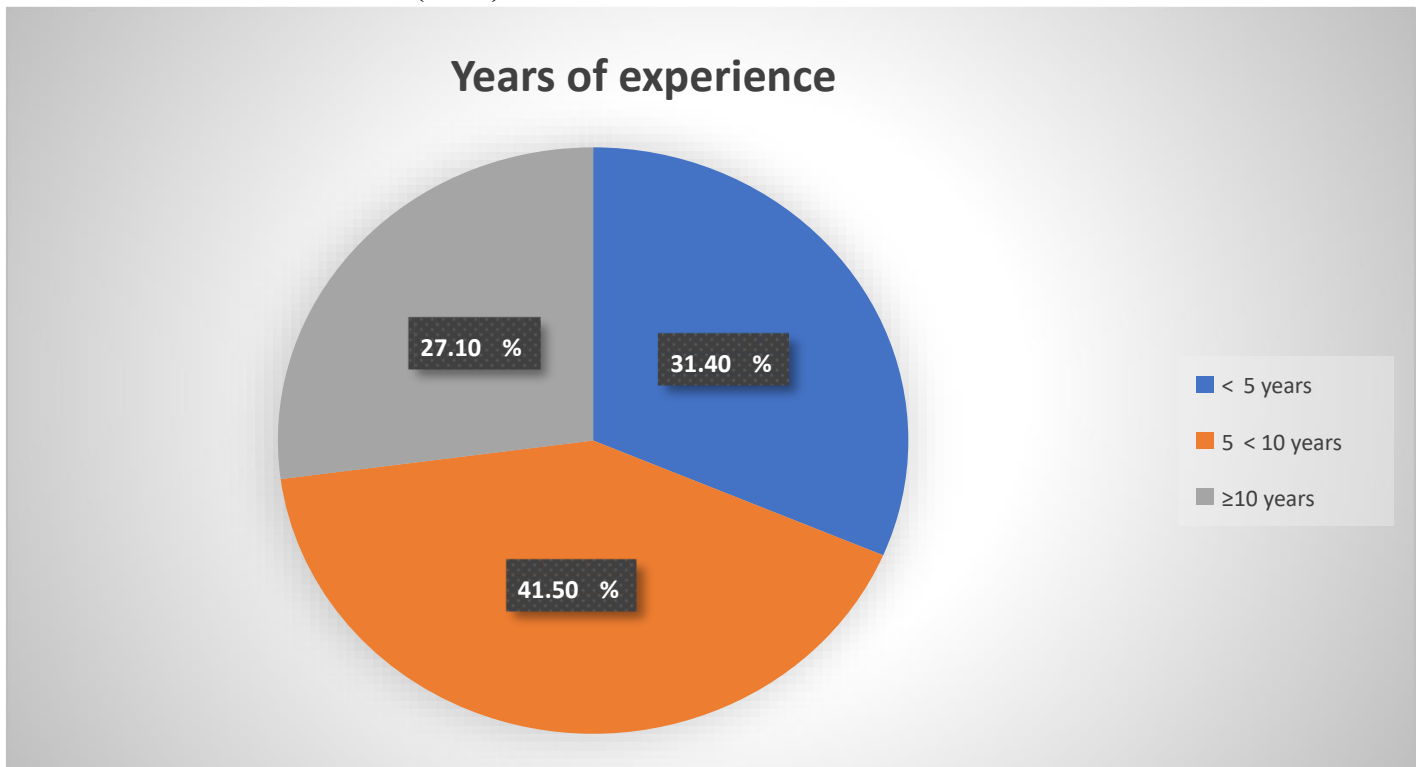


Table (2): Number and percentage distribution of the studied neonates according to personal characteristics (n=70).

Items	No.	%
Chronological age		
Less than 24 hours	2	2.9
From 1 to less than 10 days	24	34.3
From 10 to less than 28 days	40	57.1
28 days or more	4	5.7
Gestational age		
Less than 37 weeks	54	77.1
From 37 to 42 weeks	15	21.5
More than 42 weeks	1	1.4
Gender		
Male	23	32.9

Female	47	67.1
Birth weight		
Less than 1.500 Kg	3	4.2
From 1.500 <2.000 Kg	10	14.3
From 2.000 < 3.500 Kg	55	78.6
≥3.500 Kg	2	2.9
Recent weight		
Less than 1.500 Kg	2	2.9
From 1.500 <2.000 Kg	7	10.0
From 2.000 < 3.500 Kg	58	82.9
≥3.500 Kg	3	4.2

Table (3): Studied nurses' knowledge regarding parenteral nutrition and nursing care at pre and post intervention (n=70).

Items	Pre intervention				Post intervention				Chisquare p-value
	Correct		Incorrect		Correct		Incorrect		
	N	%	N	%	N	%	N	%	
Parenteral nutrition is giving the neonate what need of nutrients in the form of glucose, amino acids and fats only	32	45.7	38	54.3	64	91.4	6	8.6	11.913 .000**
Intestinal paralysis and intestinal obstruction of gastrointestinal infections that require the use of full parenteral nutrition	35	50.0	35	50.0	60	85.7	10	14.3	8.214 .000**
Calcium can be administered in the same vein used for parenteral nutrition	29	41.4	41	58.6	58	82.9	12	17.1	10.625 .000**
Measuring chemical metabolites (sodium, potassium and creatinine) daily during parenteral nutrition	37	52.9	33	47.1	59	84.3	11	15.7	5.516 .000**
Nurses can add medication to the bottle of parenteral nutrition solution	31	44.3	39	55.7	59	84.3	11	15.7	2.902 .005**
The nurse should change the peripheral cannula used to administer parenteral nutrition every 48 hours	43	61.4	27	38.6	67	95.7	3	4.3	14.225 .000**
Nursing care during parenteral nutrition includes measuring neonatal weight per day at first and then 2 to 3 times a week	39	55.7	31	44.3	66	94.3	4	5.7	8.084 .000**
The possibility of intestinal tube feeding is routinely evaluated	41	58.6	29	41.4	63	90.0	7	10.0	3.764 .000**
Not necessary to cover the bottle of parenteral nutrition solutions during preparation or administration	32	45.7	38	54.3	69	98.6	1	1.4	11.338 .000**

Input and output fluids should be mapped when parenteral nutrition is given every 24 hours	33	47.1	37	52.9	57	81.4	13	18.6	11.210 .000**
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Table (4): Studied nurses' total practices at pre and post intervention (n=70).

Total practice	Pre- intervention		Post- intervention		Chi-square p-value
	No.	%	No.	%	
Competent	49	70.0	65	92.9	25.346
Incompetent	21	30.0	5	7.1	0.000**

(**) Highly significant at $p < 0.01$ (*) statistically significant at $p \leq 0.05$

Figure (3): Studied nurses' total practices at pre and post intervention (n=70).

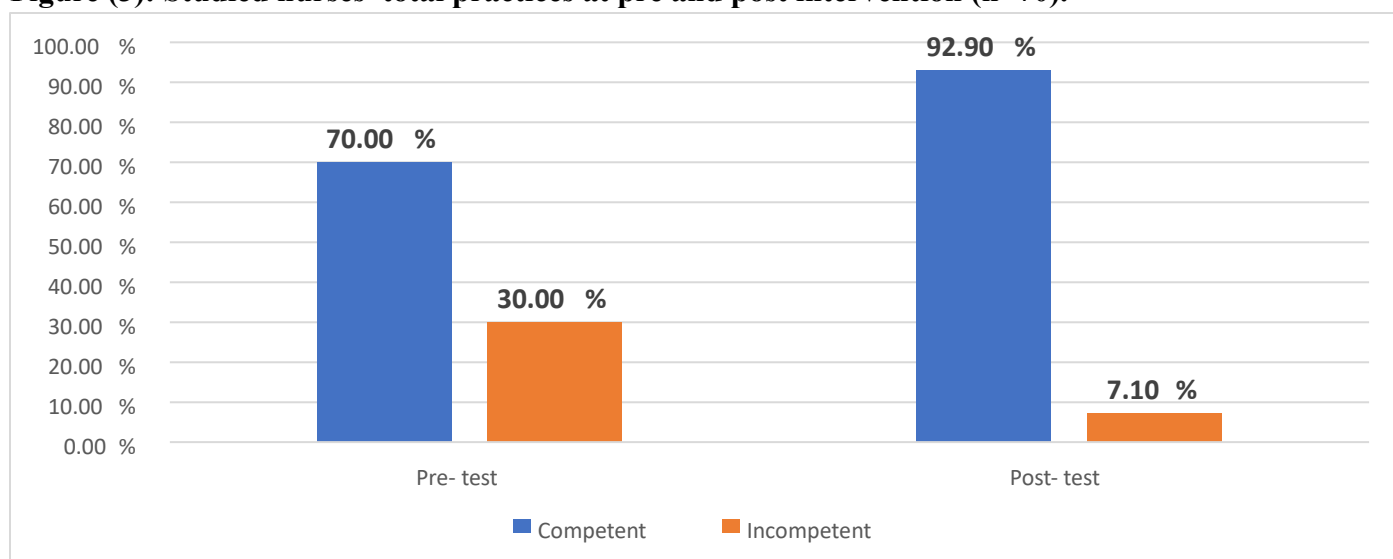


Table (5): Correlation between studied nurses' knowledge and practice at pre and post intervention (n=70).

Items	r	p
Total knowledge and practice pre	0.527	0.005**
Total knowledge and practice post	0.763	0.000**

4. DISCUSSION

With respect to the personal characteristics of the nurses under investigation, the present study (table 1) unveiled that the mean age of the nurses was 29.4 ± 2.45 years (x-SD), with the majority of them being female.

This outcome was nearly congruent with **Abdel-Fattah et al., (2018)** discovered that the mean age of the nurses under investigation was 30.98 ± 5.09 years when they did an investigation in Egypt concerning the "Quality of nurses' performance regarding parenteral feeding at newborn intensive care units." Furthermore, the findings were consistent with **Mistry, (2019)** performed a study in India to determine ICU nurses in a selected hospital had adequate knowledge of total parenteral nutrition (TPN). The results of the study indicated that women comprised over 75% of the nurses who were examined. This high percentage of female nurses may be attributable to the fact that nursing is a female-dominated profession in Egypt, according to the researcher.

According to the findings of the present study (table 1), approximately 75% of the nurses under investigation resided in rural regions. This outcome was consistent with **Aydemir et al., (2019)** conducted a study in Turkey

titled "Employing a nutrition nurse in neonatal critical care units enhanced nutrition and growth outcomes in preterm neonates" and found that rural residents comprised the majority of the nurses under study.

Furthermore, according to the findings of the present study (table 1), over 50% of the examined nurses had a degree from a health technical institute although fewer than 25% of the participants have a bachelor's degree in nursing, this finding was consistent with a study conducted by **Khalefa, (2018)** who carried out a study regarding "Evaluation of critical care The nurse's expertise and methodologies with respect to the management of infants undergoing total parenteral feeding "uncovered that the majority of participants held technical nursing degrees. In contrast, **Talat et al., (2023)** According to a study conducted in Egypt titled "Effect of Designed Nutritional Guidelines on Nurses' Performance Regarding Nutrition of Low-Birth-Weight Neonates," the majority of the nurses under investigation held a bachelor's degree in nursing.

Additionally, as demonstrated by Table 1 of the current study, fewer than one-third of the nurses under investigation had participated in training sessions on how to care for newborns receiving parenteral nourishment in a neonatal intensive care unit.

This investigation concurred with **Abo-El Ezz, (2019)** who found that more than half of the nurses in their study didn't attend any training sessions regarding the care of high-risk neonates. The study was titled "Effect of Nursing Intervention Guidelines on Nurses' Knowledge and Performance regarding Prevention and Management of Intraventricular Hemorrhage among Preterm Neonates in Tanta University, Egypt." On the other hand, **Zaki et al., (2018)** whose study entitled "Assessment of nurses' performance regarding care for neonates with necrotizing enterocolitis at intensive care units in Beni-Suef University and general Hospitals in Beni-Suef city, Egypt" and specified that over 75% of the nurses analyzed had participated in training programs pertaining to newborn care. From the researcher's perspective, this may be the result of a lack of incentive for training, insufficient personnel utilization, and a dearth of in-service training within the NICU department, all of which contribute to an increasing workload in the Neonatal Intensive Care Unit.

Furthermore, the findings of the present study (figure 1) indicated that fewer than half of the nurses analysed possessed experience in neonatal intensive care ranging from five to less than ten years. Furthermore, over a quarter of the nurses had accumulated more than ten years of experience, whereas less than one-third had less than five years of experience.

These results corroborated a study conducted by **Bakhshi et al., (2018)**, entitled "Impact of Instructions on the Developmental Status of Premature Neonates on the Clinical Practice of Neonatal Intensive Care Unit Nurse" in Iran and indicated that the majority of nurses analyzed had between five and ten years of experience. On the contrary, **Sheikh, (2021)** who performed an investigation entitled "Pre-experimental Study to Assess the Effectiveness of Self- Instructional module on knowledge Regarding Neonatal Resuscitation among the Staff Nurses Working in Selected Hospital " in India and reported that a majority of nurses, specifically more than half, had accumulated experience ranging from one to five years.

From a researcher's standpoint, nurses working in the neonatal intensive care unit (NICU) must have more years of experience in order to have adequate knowledge and practice regarding the care of neonates with low birth weight. Clinical experience offers nurses the chance to enhance their skills and knowledge in order to provide more effective nursing care.

In relation to the personal attributes of the neonates under investigation, the current study revealed (in table 2) that over 50% of them were less than 28 days old chronologically, and over 75% were below 37 weeks gestational age. This finding was consistent with research conducted by **Hendy et al (2020)**, entitled "Nursing competency for caring of high-risk neonates at neonatal intensive care unit" in Egypt and discovered that within the highest

proportion of neonates, the gestational age was less than 37 weeks and the chronological age ranged from 10 to 28 days.

Concurrently, these findings were in opposition to **Chapman et al., (2021)** who performed an investigation entitled "NICU Neonates who Require a Feeding Gastrostomy for Discharge" and discovered that a majority of the neonates in the NICU were, in fact, between 28- and 32-weeks' gestation. The observed inconsistency could perhaps be attributed to variations in the study settings and samples.

Furthermore, the current investigation revealed that almost two-thirds of the neonates under investigation were female. This outcome was consistent with **Silveira et al., (2018)** who performed an investigation entitled "Early intervention program for very low birth weight preterm neonates and their parents" in Brazil and demonstrated that almost fifty percent of the infants examined were female. On the contrary, this discovery contradicted with **Miao et al., (2019)** who performed research titled "Birth weight percentiles by sex and gestational age for twins had born in southern China" who demonstrated that males comprised more than half of the neonates.

Furthermore, the present study revealed that over 75% of the neonates under investigation had a birth weight ranging from 2,000 to 3,500 kg. In terms of recent weight, the majority of the items were between 2,000 and 3,500 kg. This outcome corresponded with **Sommer et al., (2021)** who performed an investigation in Thailand titled "Parenteral Nutrition Process Management for neonates and Preterm neonates: A Preliminary Risk Analysis", in Switzerland and revealed that the majority of the newborns under study weighed between 2,000 and 3,500 kg at birth. A study, on the contrary, undertaken by **Hesham, (2022)** in Egypt, entitled "Assessment of the Nurses' Role toward Nutritional Therapy for High-Risk Neonates" and reported that around 50% of the neonates under investigation had a birth weight of 2000-2500 gram.

With regard to the nurses' understanding of parenteral nutrition and nursing care prior to and following the intervention, the current study (table 3a) demonstrated a statistically significant increase in the nurses' knowledge of parenteral nutrition post-intervention in comparison to pre-intervention. Prior to intervention, less than half of them had accurate knowledge. However, by the time post-intervention arrives, the majority of them have achieved perfect answers.

Similarly, these results were consistent with **Ebrah et al., (2020)** who carried done a study regarding "The effect of intervention on nurse's performance regarding nutrition of premature neonate in neonatal care unit at public hospitals in Hodeida City: Yemen" indicated that previous to the intervention, over 50% of nurses possessed an inadequate level of knowledge; however, following educational sessions, the majority of them acquired such expertise.

In addition, this result corroborated a study by **Ike & Oluwatosin, (2022)** in Nigeria whose study "Effect of an Educational

Intervention on Nurses' Competency in the Neonatal Unit of a Teaching Hospital in Nigeria" and found that the mean score of nurses' knowledge on the posttest rose from 35.21 ± 6.33 on the pretest to 43.74 ± 3.30 on the posttest ($t = 7.33$, $P = .000$). The findings suggested that the teaching initiative that was executed for neonatal unit nurses improved their proficiency in delivering care for newborns. This outcome could potentially be attributed to the educational program's efficacy in enhancing the nurses' understanding of parenteral nutrition and neonatal nursing care.

In the present study (table 4 and figure 2), the total knowledge of examined nurses regarding parenteral nutrition and nursing care before and after the intervention was examined. The results revealed that while over 50% of the examined nurses possessed satisfactory knowledge prior to the intervention, this significantly changed by the time the intervention began. By the time the intervention concluded, the majority of the nurses exhibited satisfactory knowledge regarding parenteral nutrition and nursing care.

This outcome was consistent with a research conducted by **Faris & Abed, (2022)**, entitled "Effectiveness of an educational program on nurses knowledge toward parenteral nutritional support for unconscious patient at critical care unite in imam al-Hussein medical city in holy Karbala" and discovered that, at the post-test, the knowledge of the study group on parenteral nutrition support in intensive care units was larger than that of the control group; hence, the training program was successful in enhancing the knowledge of nurses.

In the same context, **Hussien & Sayed, (2021)** who conducted an investigation named "Effect of Training Program on Nurses knowledge and Practice about Total Parenteral Nutrition of Criticality ill Neonate" in Egypt and said that there was a statistically significant difference in nurses' knowledge prior to, during, and after the training program, and concluded that nurses lacked whole parenteral nutrition understanding.

As observed by the researcher, the training program effectively enhanced the understanding of nurses with respect to the comprehensive parenteral nutrition of critically ill neonates.

Based on an analysis of the entire practices of the nurses under investigation both before and after the intervention, the current study found a highly significant difference in the provision of parenteral nutrition nursing care among the nurses (table 12). After intervention, the majority of them had achieved competent total practice, whereas less than one-third of them had demonstrated incompetent total practice prior to intervention. Consequently, this outcome likewise supported the initial study hypothesis. **H1:** Nurses' knowledge and practices will be improved after implementing educational program about parenteral nutrition.

Similarly, research conducted by **Talat et al., (2023)** determined that the implemented nutritional recommendations improved the level of nursing practice with the nutrition of neonates with low birth weight. In contrast, a study that was undertaken by **Ibrahim et al., (2019)** entitled "Effect of Staff Development Program on Nurses' Performance Regarding Quality Standards of Neonatal Care" in Egypt and indicated that before to program implementation, all of the examined nurses engaged in incompetent practice. However, immediately following the program and at follow-up, more than one-third and less than one-fifth of the nurses, respectively, attained competent practice. They further stated that the staff development programme had a restricted beneficial impact on their practises and the attainment of neonatal care quality criteria. This disparity could potentially be attributed to factors such as inadequate nurse readiness for the educational program, misaligned session schedules, heightened workload, and nursing shortage. .

In regard to the correlation between the knowledge and practices of the examined nurses before and after the intervention, the current study (table 17) identified a highly statistically significant positive correlation between the knowledge and practices of the examined nurses before and after the intervention. This suggests that nurses who possess an adequate amount of knowledge appear to engage in competent practice. This outcome is consistent with the logical deduction that knowing more about a subject increases its potential for practical implementation. This finding therefore supported the second study hypothesis. **H2:** There will be a significant positive correlation between studied nurses' knowledge and practices regarding TPN.

Invariably, this outcome was concurred upon. **Elsobkey & Amer, (2018)** who determined that a positive association, which was statistically significant, existed between the overall knowledge of nurses and their total practices before and after the implementation of the guideline. On the other hand, **Ibrahim et al., (2019)** the study in question concluded that there was no statistically significant association between the overall knowledge of nurses and their overall practices immediately following the implementation of a staff development program and at follow-up. This conflict demonstrated that only possessing appropriate information is inadequate for the execution of proper practical abilities. As a result, the researcher concludes that it is necessary to motivate the neonatal nurses under study to apply their acquired knowledge and adhere to the generally accepted standards for evidence-based procedures.

5. CONCLUSION

On the basis of the current study's findings, the following may be concluded: the overall practice regarding parenteral nutrition differed significantly and statistically between pre-intervention and post-intervention. A significant proportion of the nurses possessed proficient post-intervention skills. Furthermore, the expertise of nurses was impacted by factors such as age, educational attainment, years of NICU experience, and attendance at training courses. In summary, this educational initiative substantially enhanced the expertise and application of nurses in the field of parenteral nutrition, hence resulting in improved results for neonates.

6. RECOMMENDATIONS

The following suggestions may be made in consideration of the results obtained from the present study:

Continue applying similar educational programs to ensure that the nurses have update knowledge and skills in neonatal parenteral nutrition.

Consider integrating these programs into regular curriculum to ensure continuous learning and improving in nurses' performance.

Encourage the nurses in training courses on parenteral nutrition to increase their knowledge and competences.

Periodically evaluate the effectiveness of the educational programs to identify the gaps for further improvement.

Promoting the importance of personal development among nurses to encourage them to participation in such programs.

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