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Assessment of Nurses' Performance regarding Parenteral Nutrition at Neonatal Intensive Care Units

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Abstract

Background: Parenteral nutrition is a lifesaving intervention that is used when enteral feeding is not possible or insufficient for neonate in neonatal intensive care units' neonatal nurses play a critical role in the care of neonates receiving parenteral nutrition in the NICU. Aim of the study was assess nurses' Performance regarding parenteral nutrition at neonatal intensive care unit. Design: An descriptive research design was used to achieve the aim of this study. Settings: The study was carried out at the Neonatal Intensive Care Units in Benha University Hospital. Sample: A purposive sample composed of 70 neonatal nurses working at the previously mentioned settings. Tools: Data were collected through two tools; A structured interview questionnaire sheet and an observational checklists. Results: There were more than half of studied nurses were satisfactory knowledge and more than two thirds of them had a competent total practice. Conclusion: the more than half of studied nurses were satisfactory at knowledge about parenteral nutrition and nursing care. Also, the more than two thirds of studied nurses had competent practice about parenteral nutrition. In addition, there was a statistical significant positive correlation between the studied nurses' total knowledge and their total practices. Recommendations: Periodically evaluate the nurses' knowledge and practice regarding parenteral nutrition to identify the gaps for further improvement and Replication of the study on large number sample and other setting.

Key words: NICUs, Nurses' performance, Parenteral nutrition.

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 PN in NICU is a complex and critical process that requires specialized knowledge and skills. Proper administration of PN is essential for the growth and development of premature neonates and errors

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or complications during this process can have serious consequences (Nantsupawat et al., 2021).

Neonates cannot be fed adequately by mouth or through a feeding tube (enteral) require PPN which is a feeding method that bypasses the digestive tract by delivering nutrients directly to the bloodstream. A sterile solution containing essential nutrients is given to the neonate as an infusion into a vein. 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*).

Overall, neonatal nurses play a critical role in the care of neonates receiving PN in the NICU. The responsibilities include ensuring the safe and accurate administration of PN, monitoring the neonate's response to the therapy, educating parents about the therapy and participating in the development of protocols for the administration of PN. With specialized knowledge and expertise, neonatal nurses are essential members of the healthcare team caring for neonates in the NICU (**Kintu et al., 2021**).

Significance of the study:

World Health Organization (WHO) estimates that about 30 million low Birth Weight (LBW) neonates are born annually (23.4% of all births) and they often face short and long term health consequences. While the global prevalence of LBW has slightly declined, the rate in many developing countries is still quite high (30%) (**Blencowe et al., 2019**).

In Egypt, preterm birth represents approximately 10 % of total live births (**Abdelhady & Abdelwahid., 2015**). Also, preterm birth complications comprising about 28.5% of all Egyptian deaths in children less than 5 years.

Egypt ranked as 144 worst on the list of 162 countries with prematurity related deaths (*Fala, et al., 2014*).

Mainly neonates in NICU are need of effective nutritional support. These needs are frequently met by the administration of PN, especially during the early stages of life. Knowledge and practices of the nurses that administer this therapy are two essential factors in preventing errors, provide with high quality of the care and promote the neonatal heath. Appropriate nursing care and careful biochemical monitoring are required for a successful PN therapy. In addition, appropriate clinical guidelines on relative amounts of the constituents of PN solutions lead to the proper nutritional support and protect the neonates from possible risks of PN therapy *(Deshpande et al., 2020).*

From a researcher's perspective, it is important to assess the nurses' performance regarding parenteral nutrition at NICUs because the nurses are the core personnel resources of healthcare system, so that the good nursing performance has a direct impact on patient health outcomes.

Aim of the study:

The study aimed to assess nurses' performance regarding parenteral nutrition at neonatal intensive care units.

Research questions:

What is the level of nurses' knowledge regarding parenteral nutrition at neonatal intensive care units?

What is the level of nurses' practices regarding parenteral nutrition at neonatal intensive care units?

Is there a relation between nurses' knowledge and practices regarding parenteral nutrition at neonatal intensive care units?

Subjects and methods:

Research design:

Descriptive research design was used to achieve the aim of this study.





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Setting:

The study was carried out in NICUs at Benha University hospital.

Sampling:

A purposive sample composed of all neonatal nurses (70 nurses) who are working at the previous mentioned setting.

A purposive sample composed of 70 neonatal nurses who were working at the previously mentioned settings at the time of the study, regardless of age, gender, qualifications, and years of experience.

Under the following inclusion criteria:

- Nurses' age ranged from 20 40 years.
- Nurses not less than one year of experience in the care of neonates under parenteral nutrition.

Tools of data collection:

Two tools were used to collect data in this study:

Tool I: A Designed Structured Interviewing Questionnaire Sheet:

It was designed by the researcher after reviewing the related literature. It was written in the Arabic language to gather data in relation to the following parts:

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

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

It was prepared by researcher based on related 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 checked with a model key answer and accordingly, the correct answer was given the score (1) and incorrect or unknown answer was given score (zero). The total score were summed up and converted into a percent score. It was classified into two categories:

- Satisfactory knowledge if score $\ge 75\%$ equal score ≥ 15 degree.

- Unsatisfactory knowledge if less than 75% equal < 15 degree.

It was prepared by researcher based on related 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 total score was 106, the items were evaluated as "done," was taken "one score" and "not done" was taken "zero score". These scores were summed up and converted into a percentage score. It was classified into 2 categories:

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

- Incompetent practices: if score < 80%. (0 - 84)







Tools reliability:

Tools reliability was checking the consistency of results across time, across different observers and across parts of the test itself, it was measured through coronach alpha test.

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

Ethical consideration:

Ethical approval was obtained from the Ethical Research Scientific Committee of Faculty of Nursing/ Helwan University. Then, approval to carry out this study was obtained from medical and nursing director of the neonatal intensive care units in Banha University Hospital. Also, written nurses' consent was obtained to participate in this study. Anonymity and confidentiality of the study subject was secured. Nurses were informed that all the gathered data used for research purpose only, the study was harmless and the study subjects were allow to withdraw from the study at any time freely.

Pilot study:

The pilot study was carried out on seven neonatal nurses at the NICU who represent 10% of the estimated sample size in order to test the applicability of the constructed tools and the clarity of the included questions related to nurses' knowledge and practice. The pilot also served to estimate the time needed for each subject to fill in the questionnaire. According to the results of the pilot, neither corrections nor omissions of items were performed, so the nurses were included in the pilot study, sharing in the study sample.

Administrative design:

An official permission was obtained from Dean Faculty of Nursing at Helwan University to manager of Banha University Hospital. The research met the Hospital director and explained the purpose of the study and methods of data collection in order to obtain permission and cooperation.

Field work:

Ethical approval was obtained from Faculty of Nursing/ Helwan University. Then, approval to carry out this study was obtained from medical and nursing director of the neonatal intensive care units of Banha University Hospital. Explained the aim of the study in order to obtaining permission and cooperation.

The researcher was contact with the studied nurses before collecting data of the actual study for the purpose of providing a simple explanation of the objective of the study to gain their cooperation and to assure the nurses about the anonymity of their answers and that the information will be used for scientific research only and will be strictly confidential, also the researcher clarified that the study is harmless, all the gathered data will be used for the research purpose only with confidentiality and anonymity.

The researcher visited the study setting 3 days / week (Sunday, Wednesday & Thursday) from 10 a.m. to 11 a.m. 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 started from the first of March 2022 to the end of October 2022.





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The time needed for completing questionnaire sheet was about 15 - 20 minutes for each nurse. The studied nurses were directly observed and assessed during nurses' practices regarding neonatal parenteral nutrition by observational checklist.

Statistical design:

The collected data was coded and entered into the statistical package for social sciences version 24. After completing entry the data was explored to detect any errors. Then, analyzed by the same program for presenting frequency tables with percentages. Qualitative data was presented as a number and percent. Furthermore, quantitative data was described as mean or standard deviation as appropriate. The Chi-square probability distribution is particularly useful in analyzing categorical variables. A t-test is a type of inferential statistic used to determine if there is a significant difference between the means of two groups. The correlation coefficient is a statistical measure of the strength of a linear relationship between two variables. The results were considered statistical significant at $P \le 0.05$, highly significant at $P < 0.01^{**}$ and no statistical significant P > 0.05.

Results:

Table (1) reveals that, the studied nurses' mean age was \pm SD. 29.4 \pm 2.45 years and majority (84.3 %) of them were females. Regarding academic qualifications, less than three fifths (57.1%) graduated from health technical institute while, less than one quarter (22.9%) of them had bachelor degree of nursing. As regard residence, about three quarters (74.3 %) of the studied nurses lived in rural residence. Also less than one third (31.4%) of them attended training courses on the care of neonates receiving PN.

This figure (1) portrays that More than two fifths the studied nurses' had from 5 to less than 10 years of experience in the neonatal intensive care, while less than one third (31.4%) of them had less than 5 years of experience and more than one quarter (27.1%) of them had more than 10 years of experience.

Table (2) shows that, more than half (57.1%) of the neonates 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 more than one fifth (21.5%) of them had from 37 to 42 weeks. Moreover, more than two thirds (67.1%) of them were females. Concerning 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) clarifies that, there was less than half of studied nurses (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, or administration).

Table (4) illustrates that, the more than two thirds(70%) of studied nurses had competent practice aboutparenteral nutrition and nursing care.



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Table (5) represented, that there was a statistically significant positive correlation between the studied nurses' total knowledge and their total practices.

 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			
Technical Institute of nursing	40	57.1			
Bachelor of Nursing	16	22.9			
Residence					
Rural	52	74.3			
Urban	18	25.7			
Attended training programs 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).





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 Table (2): Distribution of the studied nurses' knowledge regarding parenteral nutrition and nursing care (n=70).

Total knowledge Items	No.	%	Chi-square p-value
Satisfactory	36	51.4	21.032
Unsatisfactory	34	48.6	0.000**

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

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

Items	Correct		Incorrect		Chi- square
	No.	%	No.	%	p-value
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	11.913 0.000**
Intestinal paralysis and intestinal obstruction of gastrointestinal infections that require the use of full parenteral nutrition	35	50.0	35	50.0	8.214 0.000**
Calcium can be administered in the same vein used for parenteral nutrition	29	41.4	41	58.6	10.625 0.000**
Measuring chemical metabolites (sodium, potassium and creatinine) daily during parenteral nutrition	37	52.9	33	47.1	5.516 0.000**
Nurses can add medication to the bottle of parenteral nutrition solution	31	44.3	39	55.7	2.902 0.005**
The nurse should change the peripheral cannula used to administer parenteral nutrition every 48 hours	43	61.4	27	38.6	14.225 0.000**
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	8.084 0.000**
The possibility of intestinal tube feeding is routinely evaluated	41	58.6	29	41.4	3.764 0.000**
Not necessary to cover the bottle of parenteral nutrition solutions during preparation or administration	32	45.7	38	54.3	11.338 0.000**
Input and output fluids should be mapped when parenteral nutrition is given every 24 hours	33	47.1	37	52.9	11.210 0.000**





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 Table (4): Studied nurses' total practices (n=70).

Total practice	No.	%	Chi-square p-value
Competent	49	70.0	25.346
Incompetent	21	30.0	0.000**

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

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

Items	Total knowledge			
	r	р		
Total level of practice	0.527	0.005**		

Discussion:

Regarding personal characteristics of the studied nurses, the current study (table 1) revealed that the studied nurses' mean age was x- SD. 29.4 \pm 2.45 years and majority of them were females.

This result was nearly agree with **Abdel-Fattah et al.**, (2018) who conducted a study about "Quality of nurses' performance regarding parenteral nutrition at neonatal intensive care units", in Egypt, and found that the studied nurses' mean age was 30.98 ± 5.09 years. Also, these results were in accordance with Mistry, (2019) conducted a study to assess the "Knowledge regarding Total Parenteral Nutrition (TPN) among the ICU Nurses in Selected Hospital of Pune City", in India, who revealed that more than three quarters of the studied nurses were female.

From the researcher point of view, this high percentage of the female nurses may be related to nursing is a female dominated profession in Egypt.

The current study (table 1) represented that about three quarters of the studied nurses lived in rural area.

This result was congruent with **Aydemir et al.**, (2019) who carried out a study entitled "Employing a nutrition nurse in neonatal intensive care unit improved nutrition and growth outcomes in preterm neonates", in Turkey, and stated that the most of the studied nurses were rural residents.

As well, the current study (table 1) reflected that more than half of the studied nurses graduated from health technical institute while, less than one quarter of them had bachelor degree of nursing these results were in the same line with a study carried out by Khalefa et al., (2018) who conducted a study about "Assessment of critical care nurse's knowledge and practices regarding care of neonates receiving total parenteral nutrition" and found that most of nurse's participants had technical nursing. On contrary, Talat et al., (2023) in a study entitled "Effect of designed nutritional guidelines on nurses' performance regarding nutrition of low birth weight neonates" in Egypt, who viewed that, the highest percentage of the studied nurses had Bachelors degree of nursing science.



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Moreover, the current study (table 1) showed that less than one third of the studied nurses had attended training courses on the care of neonates receiving PN at NICU.

This study agreed with **Abo-El Ezz**, (2019) who conducted a study about "Effect of nursing intervention guidelines on nurses' knowledge and performance regarding prevention and management of intra-ventricular hemorrhage among preterm neonates in Tanta University, Egypt" and found that, more than half of studied nurses didn't attend any training courses about care of high risk neonates.

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 clarified that more than three quarters of the studied nurses attended training courses regarding neonatal care.

From the researcher point of view, this may be due to of in - service of training in department of NICU, lack of motivation for training and shortage of using staff that lead to increased work overload in Neonatal Intensive Care Unit.

Additionally, the current study (figure1) revealed that less than half the studied nurses' had from 5 to less than 10 years of experience in the neonatal intensive care, while less than one third of them had less than 5 years of experience and more than one quarter of them had more than 10 years of experience.

These findings agreed with a study done 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 reported that, the majority of studied nurses had 5-10 years of experience. In contrast, **Sheikh**, (2021) who conducted a study 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, more than half of nurses their years of experience was ranged from 1-5 years of experience.

From the researcher point of view, nurses in NICU require more years of experience to have good knowledge and practice regarding care of low birth weight neonates, clinical experience provide an opportunity for nurses to expand their skills and knowledge to practice effective nursing care.

Pertaining to the studied nurses' knowledge about PN and nursing care at (table 3) less than half of them have correct knowledge.

Likewise, these result was in the same line with Smith et al., (2020) who conducted a study about " Understanding and Application of Parenteral Nutrition among neonatal nurses working in NICUs" who showed that less than half of the surveyed nurses possessed accurate knowledge regarding PN and its implications for patient care. Smith et al. attributed this gap in knowledge to several factors, including inadequate training programs and a lack of exposure PN cases during clinical rotations. They to emphasized the critical importance of enhancing educational resources and practical experience opportunities for nursing students to better equip them with the skills and knowledge needed to administer PN effectively.

As well, this result disagreed with **Baghlani** et al., (2019) who conducted a study about " Neonatal





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Intensive Care Unit Nurses' Perceptions and Knowledge of Newborn Individualized Developmental Care and Assessment Program: A Multicenter Study" who showed that the majority of nurses participating had high knowledge.

Regarding studied nurses' total knowledge about parenteral nutrition and nursing care indicated that more than half of the studied nurses was satisfactory at about parenteral nutrition and nursing care with highly significant difference between pre and post intervention.

This result was in harmony with a study carried out 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 found that the study group's knowledge of parenteral nutrition support in critical care units is greater to that of the control group at the post-test, as compared to the control group's knowledge, so the educational program was effective in increasing nurses' knowledge.

In the same context, **Hussien & Sayed**, (2021) who performed a study entitled "Effect of Training Program on Nurses knowledge and Practice about Total Parenteral Nutrition of Criticality ill Neonate" in Egypt and stated that there was statistically significant difference between nurses' knowledge pre, immediate and post training program and concluded that nurses had lack of knowledge regarding total parenteral nutrition.

According to the studied nurses' total practices. reflected that less than one third of them had incompetent total practice. Therefore, this result also answered the first questions. Likewise, a study carried out by **Talat et al.**, (2023) found that the designed nutritional guidelines was effective in improving nurses' practices level regarding nutrition of low birth weight neonates.

On the other hand, a study conducted by Ibrahim et al., (2019) entitled "Effect of staff development program on nurses' performance regarding quality standards of neonatal care" in Egypt and stated that all the studied nurses achieved incompetent practice before the program implementation, while more than one third and less than one fifth of them achieved competent practice immediate post program and at follow up, respectively. They added that there was a limited positive effect of staff development program on their practices and on the achievement of quality standards of neonatal care. This discrepancy may be related to lack of nurses preparedness to the educational program, improper timing of sessions, increase the work load and shortage of nurses.

Pertaining to correlation between studied nurses' knowledge and practices, the current study (table 5) highlighted that highly statistically significant positive correlation between the studied nurses' total knowledge and their total practice. This can be interpreted as nurses who have satisfactory level of knowledge seem to have competent practice.

Consistently, this result was agreed with **Elsobkey & Amer**, (2018) who carried out a study reported that there was a statistically significant positive correlation between nurses' total knowledge and total practices.

On the other hand, **Ibrahim et al.**, **(2019)** whose study declared that there was no statistical significant correlation between total knowledge of nurses and



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their total practices immediately post and at follow up of staff development program implementation. This contradiction was indicating that only having adequate knowledge is not sufficient to perform correct practical skills. Therefore, the researcher believes that the studied neonatal nurses need to be encouraged to translate their knowledge into practice and adopt the acceptable guidelines on evidence based practices.

This result follows the logic that increasing knowledge of any topic leads to greater potential of its application.

Conclusion

Based on findings of the current study, it can be concluded that; the more than half of studied nurses were satisfactory at knowledge about parenteral nutrition and nursing care. Also, the more than two thirds of studied nurses had competent practice about parenteral nutrition. In addition, there was a statistical significant positive correlation between the studied nurses' total knowledge and their total practices.

Recommendations:

In the light of the findings of the current study the following recommendations can be suggested:

- Continue ensure that the nurses have update knowledge and skills in neonatal parenteral nutrition.
- Integrating parenteral nutrition programs into regular curriculum to ensure continuous learning and improving in nurses' performance.
- Encourage the nurses in training programs on PN to increase their knowledge and competences.

- Periodically evaluate the nurses' knowledge and practice regarding PN to identify the gaps for further improvement.
- Replication of the study on large number sample and other setting.

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