Effect of an Educational Program on Nurses' Performance Regarding Care Provided for Neonates with Hypoglycemia at Neonatal Intensive Care Units

Manar Antar Amir Said[1], Hanan Nabawy ELaasar[2] and Yasmin Abdel- Ghany Abdel-fatah[3]
(1) Demonstrator in Pediatric Nursing, Faculty of Nursing, Aswan University, (2) Assistant Professor of Pediatric Nursing,Faculty of Nursing,Benha University and (3) Lecturer of Pediatric Nursing, Faculty of Nursing,Benha University.

Abstract

Background: The most frequent metabolic abnormality seen in newborns is hypoglycemia. A major problem in the treatment of the newborn is screening at-risk newborns and managing low blood glucose levels in the first few hours to days of life. Muscle weakness, glycogen depletion, brain energy failure and decreased glucose production are all consequences of severe glucose deprivation. The preservation of the supply of glucose to all organs is a crucial physiological process. **The study aim was to:** Evaluate the effect of an educational program on nurses' performance regarding care provide for neonates with hypoglycemia at neonatal intensive care units. **Research design**: A quasi-experimental design was utilized to conduct this study**. Settings**: The current study was conducted at the neonatal intensive care unit, at Benha university hospital, Benha Specialized Pediatric. **Sample:** A convenient sample of all available nurses (80) working in previous mention setting& Neonates (80). **Tools:** Three tools were used, **Tool (I):** A structured interviewing questionnaire sheet including the following parts: **Part (1):** Personal characteristics of the studied nurses. **Part (2)**: Personal characteristics of studied neonates **Part (3):** A questioner sheet to assess nurses' knowledge Tool **(II):** An observational checklist to assess nurses' practice **Tool (III):** A questioner to assess nurses' attitude**. Results:** There were a statistically significant differences in improvement nurse's knowledge, practice and attitude regarding care of neonates with hypoglycemia pre / post program implementation. **Conclusion:** The educational program was effective in improving nursing knowledge, practice and attitude regarding care of neonates with hypoglycemia. **Recommendation**: Emphasizing on the importance of continuing in service education for nurses regarding care of neonates with hypoglycemia to keep them up-to date in knowledge, practice and attitude.

Keywords: Educational program, Nurses' performance, Hypoglycemia and Neonates.

Introduction

Glucose serves as the fetus's primary metabolic fuel source. The fetus receives glucose from its mother through carrier-mediated diffusion across a placental concentration gradient, fetal glucose levels are around 80% of maternal levels and fluctuate in tandem with changes in maternal glucose levels, insulin is produced at lower glucose concentrations in the fetus than in postnatal life, and it functions as a growth hormone rather than as a glucose regulator **(Kole et al .,2020).**

Studies' findings on the prevalence of hypoglycemia in newborns varies depending on the diagnostic cutoff, Glucose screening procedure, and the diagnostic threshold. On the other hand, it is estimated that 5–15% of newborns experience transient neonatal hypoglycemia, which affects roughly 50% of newborns who are at risk. Although they can exacerbate it, several risk factors do not raise

the incidence of hypoglycemia in newborns (**Mitchell et al .,2020**).

Clinical signs and symptoms of neonatal hypoglycemia include cyanosis, apnea, and altered state of consciousness, convulsions, lethargy, and poor feeding. It is recommended that all newborns with risk factors have routine glucose monitoring because most of these signals are non specific and the majority of these neonates do not show any clinical signs when they have low glucose concentrations. (**Shimokawa et al., 2019**).

Brain function requires adequate blood glucose levels. Low blood sugar can impair the brains ability to function. According to **Qiao et al., 2020**), severe or prolonged hypoglycemia can lead to seizures and catastrophic brain damage. High-quality medical care provided right away following the crucial period of labor and delivery is the most crucial strategy for lowering newborn morbidity and mortality. Long viewed as a crucial component of nursing practice, health promotion. It involves the sharing of health-related knowledge and the growth of the abilities, perspectives, and self-assurance needed to take action to enhance health. (**Elhag &Bassyonie, 2019**).

The first days of life, newborns with hypoglycemia require special nursing care. The effects of intermittent hypoglycemia in newborns have been a subject of discussion, despite the fact that, protracted, symptomatic, or extreme hypoglycemia has long been known to impair the neonatal central nervous system. While some people think transitory newborn hypoglycemia is a normal physiological process that won't affect the baby, others think it could harm the baby's developing brain (**Raviv et al ., 2020**).

Significance of the study

Hypoglycemia occurs in 1.3–4.4 per 1000 full-term newborns and 15–55 per 1000 preterm newborns. This demonstrates that adaptive mechanisms are not sufficiently established, which predisposes neonates to increased risk of hypoglycemia, and gestational age has a significant impact on its beginning in some groups. The prevalence of hypoglycemia in full-term newborns is currently estimated to be 10%. Neonatal mortality rates were 6.5% for neonates that were appropriate for gestational age (AGA), 8% for large for gestational age (LGA), 15% for small for gestational age (SGA) neonates, and 15.5% for late-preterm infants. Neonatal hypoglycemia is typically linked to risk factors, such as; the mother's age at delivery, diabetic mother, and the size of the newborn. In fact, newborn hypoglycemia is more common in high-risk neonates (**Paul, 2020**).

Neonates' death within the first 28 days of life are usually caused by infections and diseases associated with substandard prenatal and postpartum care in a study regarding the knowledge and practice of immediate newborn care, it was found that nurses had inadequate knowledge and poor practice, according to Abdu **et al., (2019).** Therefore, the researcher believed that to improve nurses, knowledge and practice which may lead to improved outcomes it was imperative to conduct educational programs for nurses about the care given for neonates with hypoglycemia at neonatal intensive care units.

Strengthening, maintaining newborn care and make sure that appropriate and active care is given requires that all neonatal nurses should take part in a continuing education program about caring for neonates with hypoglycemia. In addition to being active

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tools for providing nursing care in the NICU, instruction and direction can help transform practice jobs and enhance their awareness. **(Pinchefsky &Tam , 2022)**.

Aim of the study

The study's aim was to assess the effect of an educational program on nurses' performance regarding care provided for neonates with hypoglycemia through the following:

1. Assessing nurses' knowledge, practices, and attitude regarding neonatal hypoglycemia.
2. Designing an educational program about neonatal hypoglycemia based on the nurses' actual needs.
3. Implementing and evaluating the effect of an educational program on the nurses' knowledge, practices and attitude.

Research Hypothesis

The educational program will improve nurses' knowledge, practices and attitude regarding care provided for neonates with hypoglycemia.

Subjects and Method

The study was portrayed under the four main designs as following: -

Research design:

A quasi-experimental research design was utilized to carry out this study.

Setting:

The current study was carried out at Neonatal Intensive Care Units at Benha University hospital affiliated to university and Benha Specialized Pediatric Hospital at Benha city affiliated to ministry of health and population. NICUs at Benha university hospital located in the fourth floor and consist of one room had (22) incubators, NICUs at Benha specialized pediatric hospital located on the third floor in building A and consist of

two rooms with (7) incubators, and fifth floor in building B that had (6) incubators

Subject

(1) A convenient sample of (80) nurses, working at the previously mentioned settings regardless of their characteristics who providing care for neonates with hypoglycemia, was divided into two groups (pre/post). Nursing staff from Benha University hospital was (35) and Benha Specialized Pediatric Hospital was (45).

(2) Purposive sample of (80) neonates with neonatal hypoglycemia were included after fulfilling the following criteria:

Inclusion criteria:

A) Newborns from the age of 1 day to 28 days old.

b) Any newborn who had hypoglycemia.

a) Tools of data collection and techniques:

Data was collected through using the following three tools:

Tool (I): A Structured Interviewing Questionnaire Sheet:

It was developed by the researchers in the light of relevant recent literatures adapted from **Fadnil, (2016)** to assess nurses' knowledge of care given to newborns with hypoglycemia and modified to suit the study. This tool was translated into an Arabic language and consisted of three parts of the following:

Part (1): Personal characteristics of the studied nurses' such as; age, gender, level of education, years of experience and attendance of training courses related to neonatal hypoglycemia.

Part (2): Personal characteristics of the studied neonates such as; age, gender, medical

diagnosis, type of birth, gestational age, weight on admission and current weight.

Part (3): Nurses' knowledge of newborn hypoglycemia**:** it was developed and revised by the supervisors after reviewing the recent literature to assess nurses' knowledge regarding care of neonatal hypoglycemia it included (85) multiple choice questions such as; definition of hypoglycemia, causes of hypoglycemia, signs and symptoms of neonatal hypoglycemia , neonates that were at high risk for hypoglycemia, diagnosis of hypoglycemia, complications of neonatal hypoglycemia, the best treatment of neonates with hypoglycemia ,convulsion associated with neonatal hypoglycemia , causes of convulsions resulting from hypoglycemia, complications of these convulsion and nursing role to treat neonatal hypoglycemia .

Scoring system for nurse's knowledge:

The studied nurses' answers were compared to a model key answer designed as following; a score (2) for complete correct answers, a score (1) for incomplete correct answers and (0) for the wrong answers and don't know. The overall knowledge scores ranged from (0-85mark). The total level of nurses' knowledge was calculated and divided into two levels as following: -

- \> 85% was considered unsatisfactory.

- ≤ 85% was considered satisfactory.

- **Tool (II): An observational checklist regarding neonatal hypoglycemia:**
It was modified by **Hawi, & Khudhair, (2021)** to assess nurse's practice regarding neonatal hypoglycemia. It consisted of (120) items divided into hand washing(12 items), measuring vital sings (40 items), administration of glucose intravenously (14 items) , monitoring glucose (18 items),

oxygen therapy (14 items) , bottle feeding (9 items) and weight measurement (13 items).

Scoring system for nurses' practice:

The scoring system of nurses' practice was divided as the following: a score (1) for each step done and (0) for each step not done. The total scores were ranged from (0-120 mark), the total level of nurse's practices was divided into two levels as following: -

- Less than 100% was considered incompetent practice.

- A score equal to 100% were considered competent practice.

Tool (III): Nurses' attitude regarding neonatal hypoglycemia:

It was modified by **Fadnil, (2016),** to assess nurse's attitude regarding neonatal hypoglycemia. It consisted of 12 items as the following; In your opinion NICU is adequately supplied with sufficient number of staff members for providing the necessary care, in your point of view are all neonates at a potential risk for having neonatal hypoglycemia, do you believe that giving glucose 5 or 10 % via I.V to neonates immediately after birth is a very important step for preventing neonatal hypoglycemia, do you think that giving glucose to neonates is a very dangerous procedure need require care, from your point of view preventing hypoglycemia doesn't require application of standards of infection control, do you think that the efficiency of the nurse in NICU reduce errors during providing care, in your opinion working with two cases at the same time effects on neonatal care, do you think that there is necessary medications in your NICU for providing the necessary care, in your opinion nurses need enough training to provide necessary care and prevent neonatal hypoglycemia, from your point of view working under stress make the mistake, do you the think the time in your shift is not

adequate to provide necessary care, do you belief that providing adequate breastfeeding immediately after the birth can prevent neonatal hypoglycemia. Each item was ranged from (0-4): (0) was given for disagree, (1) was given for slightly disagree ,(2) was given for sometimes, (3) was given slightly agree, (4) was given for strongly agree.

Scoring system for nurses' attitude:

Scoring system for nurses' attitude designed as following; a score (0) for disagree, a score (1) for slightly disagree, a score (2) for sometimes, a score (3) for slightly agree and a score (4) for strongly agree. The total scores were ranged from (0-4 mark). The total level of nurse's attitude was divided into two levels as following:

- >75% were considered negative attitude.

- ≤ 75% were considered positive attitude.

Content validity:

It was ascertained by panel of three experts in the field of pediatric nursing specialists from Benha faculty of nursing to test face and content validity. The experts examined the tools for clarity, relevance, comprehensiveness, simplicity and applicability. Although the experts agreed on the content but their opinion was elicited regarding the format, layout, paraphrasing, consistency, accuracy and relevancy of the tools and recommended minor language changes that would make the information clearer and more precise. The necessary modifications were done accordingly.

Reliability:

Internal consistency reliability of all items of the tools was assessed using Cronbach's alpha coefficient. On the structured questionnaire sheet, it was (r =

0.733) for knowledge, (r=0.674) for practice using observational checklists, and (r= 0.825) for attitude.

Ethical considerations:

Before beginning the study, an ethical approval was obtained from scientific research ethical committee Faculty of Nursing Benha University, hospital administrators and head of department of Neonatal Intensive Care Unit of Benha Specialized Pediatric Hospital and Benha University hospital. Each participant had given their consent before collecting data after explanation of the study aim in a simple and clear manner. They were assured that information obtained used only for the purpose of the study and the study was harmless. The results and the collected data were kept confidentially. Additionally, each participant has the right to withdraw from the study at any time without giving causes. Nurses' norms, beliefs and habits were taken into researcher consideration.

Pilot study:

A pilot study was conducted on 10% (8 nurses &8 neonates) This phase required a time of one month from beginning of (April 2022 to the end of April 2022) to test the research feasibility, clarity, objectivity, applicability of the study tools and then, any necessary modifications were made and an estimate the time needed for conduction of the study. Because no significant changes were made to the study tools the subjects of pilot study were included in the study sample.

Field work:

Assessment phase

The process of data collection carried out from the beginning of May (2022) to end of October (2022) took place over a six months. The researcher using previously mentioned tools to collect data during two weekly visits to the NICU at Specialized

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Pediatric Hospital in Benha city and Benha university hospital on Saturday and Sunday morning &afternoon, respectively. Prior to collecting data, the researcher conducted interviews with available NICU nurses to explain the purpose of the study and obtain their verbal consent to participate, then the researcher evaluated the nurses' performance regarding care of neonates with hypoglycemia using questionnaires sheet and an observation checklist.

Pre-program implementation

First, the researcher explained the interviewing questionnaire sheet before giving it to each nurse. the interviewing questionnaire sheet was administered by the researcher to all nurses individually to assess their knowledge about neonate's hypoglycemia. The average time needed for to complete the questionnaire sheets was between 10 to 15 minutes.

Second, using a NICU observational checklist, the researcher observed nurses' when they provided care for newborns who had hypoglycemia. Each observation took an average time between 15 to 25 minutes for completing.

Third, the researcher questioned NICU nurses' on their attitudes about newborns who had hypoglycemia. Each questionnaire took an average time between 10 to 20 minutes for completing.

Precautionary measures were taken.

When collecting data, precautionary measures were considered, including the use of personal protective materials such as, face masks and, anti-septic solutions for hand hygiene. Additionally, avoid shaking hands or coughing to minimize droplet transmission, keep a minimum 1.5 m distance, and avoid touching the mouth, nose or eyes to stop the spread of infection.

Program construction

The educational program for nurses was designed by the researcher according to the nurses' actual needs regarding care of neonates with hypoglycemia. It was developed, revised and changed based on the relevant literature to advance the nurse's knowledge and practices regarding care of neonates with hypoglycemia. The contents were written in Arabic language to be understandable to nurses and to be simple, well organized and scientific. This was taken a period between the start of mid-September and the end of October.

General objective of the program:

The general objectives of the program were improving nurses' knowledge, practice and attitude regarding care of neonates with hypoglycemia.

Specific objectives:

1) Define the neonate.
2) Explain normal of growth and development of neonatal period.
3) Describe the characteristics of a neonates.
4) List needs of neonate.
5) Explain the anatomical structure of pancreas gland.
6) List the functions of the pancreas gland.
7) Describe injuries of pancreas gland.
8) Define of neonatal hypoglycemia.
9) List the risk factors that lead to neonatal hypoglycemia.
10) Enumerate the causes of neonatal hypoglycemia.
11) Mention signs and symptoms of neonatal hypoglycemia.
12) Recognize how to avoid neonatal hypoglycemia.
13) Discuss the nurse's role in dealing with neonatal hypoglycemia
14) List the complications resulting neonatal hypoglycemia.
15) Define of convulsions.

16) Discuss the causes of convulsions in neonates.

17) Recognize the signs and symptoms of convulsions in neonates.

19) List the complications resulting from the occurrence of convulsions in neonates.

20) Discuss the nurse role of controlling convulsions in neonates

21) Apply nurses' practices towards caring for neonates with hypoglycemia.

22) Explain nurses' attitude regarding neonatal with hypoglycemia.

Implementation of the program

The implementation phase was completed over the course of eight sessions, with each session beginning by a summary of the previous session and objectives of the new one. Taking into consideration, the use of an Arabic language that suits the nurses' educational level. Motivation and reinforcement during session were used to enhance motivation for the sharing in this study. The first day was for the theoretical component intervention, the second day was for applying the practical portion, and the third day was for nurses' evaluation. Eight sessions in total three theoretical and five practical were held. Sessions have lasted a total of 224 hours (134 hours of practice and 90 hours of theory). In two hospitals, the nurses were divided into 18 groups, each with two or three nurses. The theoretical sessions were held at Benha university hospital and Benha Specialized Pediatric Hospital from 10:00 AM to 12:00 PM. The theoretical sections cover topics such as definition, causes, signs and symptoms, high risk, diagnosis, complications, treatment, They also cover convulsions associated with neonatal hypoglycemia, causes of these convulsions , complications of these convulsion and the role of nursing in treating neonatal hypoglycemia. Added content

included a. Each nurse was received an additional booklet and the researcher continued to reinforce the learned knowledge and provide feedback.

The practical sessions began on Saturday at Benha Specialized Pediatric Hospital from10:00 AM to 2:00 PM and continued on Sunday at Benha university hospital from10:00 AM to 2:00 PM. The practical parts cover nursing procedures related to hand washing, measuring vital sings, give glucose intravenously, glucose monitoring, oxygen therapy, bottle feeding and weight measurements, for each group. Teaching methods included lecture, group discussions, demonstrations, and remonstration; brainstorming, teaching materials included handouts, visual aids, and videos to help proper understanding of the content by nurses. Beginning in early October 2022, the implementation and evaluation phase began.

Evaluation phase

Immediately after implementation of the program contents, the post tests were used to evaluate nurses' knowledge, practice and attitude using the same formats as the pretest. This helped to evaluate the effect of an implemented program.

Administrative design:

Written approval was obtained from Dean of Benha faculty of nursing to the directorates of Benha university hospital and Specialized Pediatric hospital. The research introduced a brief explanation regarding aim, tools and the study technique to the administrators of the previously mentioned settings to gain an approval for conducting the study.

Statistical analysis:

The collected data from the studied sample was organized, categorized, analyzed

and tabulated then revised, coded and entered using computerized data entry and statistical analysis were fulfilled using the Statistical Package for Social Sciences (SPSS) version 20. Data were presented using descriptive statistics in the form of frequencies, percentages. Chi-square test (X^2) was used for comparisons between qualitative variables and correlation coefficient (Spearman's rank test) was used to test correlations between variables. Statistical significant was considered at p-value <0.05 while high significant statistically at p-value <0.001.

Results

Table (1): Shows that, more than one quarter of studied nurses (28.8 %) are aged 30 < 40 years with mean age of **33.51±7.21**years, less than two thirds of studied nurses (62.5%) are female. Also, that, more than one thirds of the studied nurses (37.5%) have nursing institute concerning the years of experience, the table show that, more than one third (38.8 %) of studied nurses have 5< 10 years of experience with mean of **9.51±5.41** years. Regarding attending training courses all of them (100.0 %), don't have training course related to care of neonates with hypoglycemia.

Table (2): Clarifies that, less than half of studied neonates (46.3 %) are aged from 7 to less than 15 days with mean age of 13.17±4.11 days, also more than half of them (52.5 %) are male. This table also illustrated that, less than three quarters of the studied neonates (73.8 %) their medical diagnosis is hypoglycemia. Moreover, less than half of studied neonates (43.8%) their weight on admission is 1 to less than 1.5 kg, with mean ±SD 1.05±0.721. Concerning to current weight less than half 46.2 % of studied neonate were 1.5 < 2 kg with mean ±SD 1.75±0.82 and more than two thirds 70.0% of them were delivery cesarean section. Regarding to gestational age/ weeks less than half 47.5% of

studied neonate were 38 to 42 weeks with mean ±SD 38.14±2.16 and more than half 60.0% of them had LGA Gestational weight.

Figure (1): Shows that, nearly three quarters of the studied neonate (73.8%) suffered from hypoglycemia and the minority of them (7.4 %) suffered from respiratory distress syndrome and sepsis.

Figure (2): Reveal that, less than two thirds (63.7%) of the studied nurses have unsatisfactory level of knowledge pre-educational program implementation, while the majority of them (83.7 %) have satisfactory level of knowledge post educational program implementation. This figure illustrates that, there is highly statistically significant difference regarding total studied nurses' knowledge about hypoglycemia pre/post educational program implementation (P < 0.001).

Figure (3): Showed that, the majority (85.0%) of the studied nurses implementation, while more than three quarters (77.5 %) of them have competent level of practice post educational program implementation. Moreover, there is highly statistically significant difference regarding the studied nurses' total practices pre/post educational program implementation (P < 0.000).

Figure (4): Illustrates that, less than half (45.0%) of the studied nurses have negative attitude regarding neonatal hypoglycemia pre-educational program implementation, while the majority (82.5 %) of them have positive attitude regarding neonatal hypoglycemia post educational program implementation. Moreover, there is highly statistically significant difference regarding total attitude studied nurses about neonatal hypoglycemia pre/post educational program implementation (P < 0.001).

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Table (1): Percentage distribution of studied nurses regarding to their personal characteristics (N=80).

Personal characteristics for the studied nurses	No	%
Age / years		
< 20	17	21.2 %
20 < 25	18	22.5 %
25< 30	22	27.5 %
30 > 40	23	**28.8%**
Mean ±SD	**33.51±7.21**	
Gender		
Male	30	37.5 %
Female	50	**62.5 %**
Level of education		
Nursing diploma	11	13.7 %
Nursing institute	30	**37.5 %**
Nursing Bachelor	15	18.8 %
Post graduate	24	30.0 %
Years of experience		
<1	16	20.0%
1< 5	18	22.4%
5 <10	31	**38.8%**
>10	15	18.8%
Mean ±SD		**9.51±5.41**
Training course regarding care provided for neonates with hypoglycemia		
No	80	**100.0%**

Table (2): Percentage distribution of studied neonate regarding to their personal characteristics (N=80)

Personal characteristics for the studied neonates	No.	%
Age/days		
1 < 7	20	25.0 %
7 < 15	37	**46.3 %**
15< 22	9	11.2 %
22 > 30	14	17.5 %
Mean ±SD	**13.17±4.11**	
Gender		
Male	42	**52.5 %**
Female	38	47.5 %
Weight on admission/ kg		
< 1	41	51.3 %
1 < 1.5	35	**43.8 %**
1.5< 2	2	2.4 %
2 to more	2	2.5 %
Mean ±SD	**1.05±0.721**	
Current weight/ kg		
<1	9	11.2 %
1 < 1.5	17	21.3 %
1.5< 2	37	**46.2 %**
2 to more	17	21.3 %
Mean ±SD	**1.75±0.82**	
Type of delivery		
Normal	24	30.0 %
Cesarean section	56	**70.0 %**
Gestational age/ weeks		
28 < 32	0	0 %
32 < 35	7	8.7 %
35 < 38	35	43.8 %
38 to 42	38	**47.5 %**
Mean ±SD	**38.14±2.16**	
Gestational weight		
SGA	20	25.0 %
LGA	48	**60.0 %**
AGA	12	15.0 %

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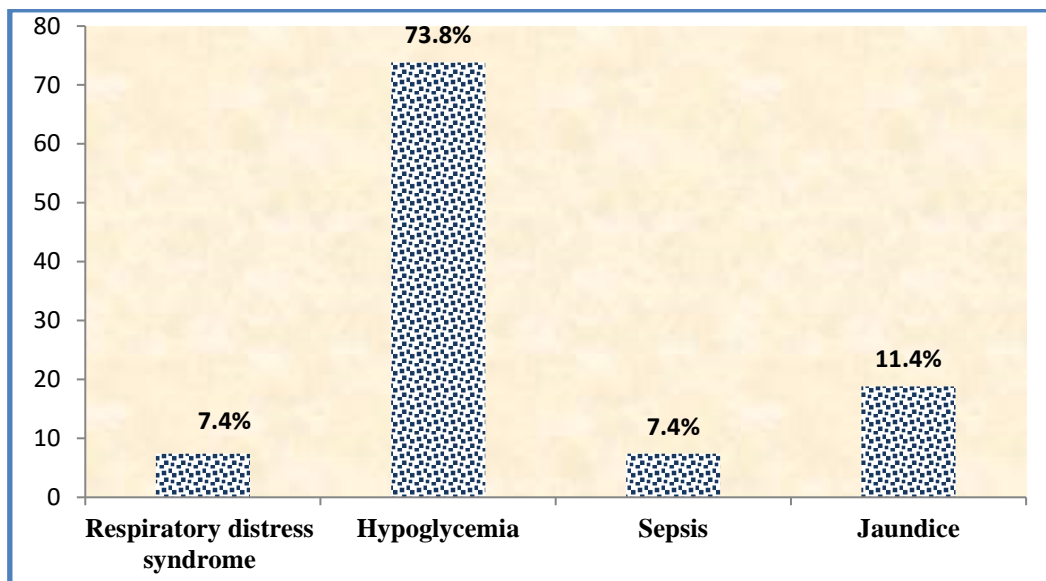

Figure (1): Percentage distribution of the medical diagnosis of studied neonate (N=80).
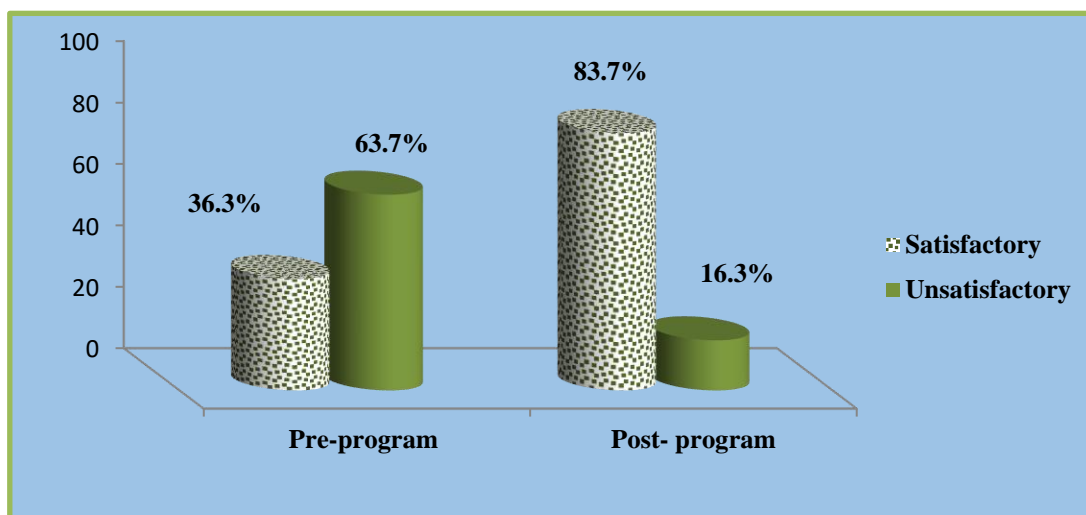
Highly statistical significance difference (P<0.000)

Figure (2): Total knowledge of studied nurses about hypoglycemia pre / post an educational program (N=80).

Highly statistical significance difference (P<0.000)

Figure (3): Total practices of studied nurses regarding to their practices in the study group pre / post an educational program (N=80)
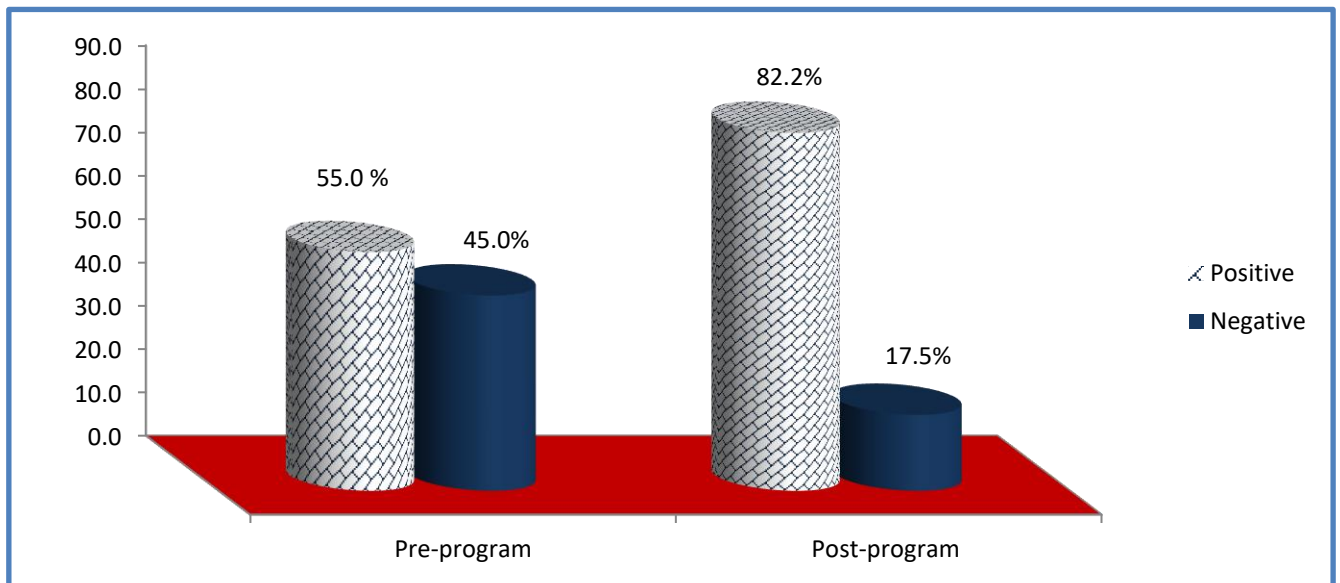
Highly statistical significance difference (P<0.000)

Figure (4): Total attitude level of studied nurses regarding attitude level about hypoglycemia in the study group pre/post an educational program (N=80).

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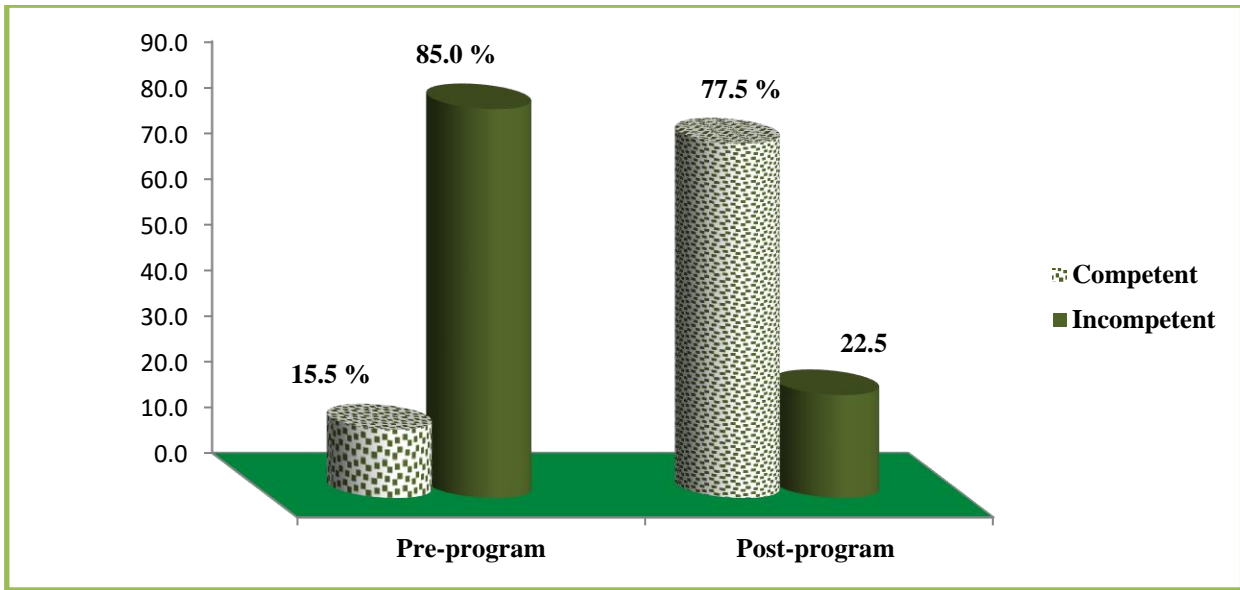
Table (3): Relation between total nurses' knowledge and their personal characteristics level pre / post an education program (N=80).

Items	Pre education program(N=80)				X^2	p-value	Post education program(N=80)				X^2	p-value
	Unsatisfactory (N=51)		satisfactory (N=29)				Unsatisfactory (N=13)		satisfactory (N=67)			
	No.	%	No.	%			No.	%	No.	%		
Age /years												
< 20	11	21.6%	6	20.7%	.738	0.864	3	23.1%	14	20.9%	2.857	0.414
20< 25	10	19.6%	8	27.6%			5	38.4%	13	19.4%		
25< 30	15	29.4%	7	24.1%			3	23.1%	19	28.4%		
30> 40	15	29.4%	8	27.6%			2	15.4%	21	31.2%		
Gender												
Male	19	37.3%	11	37.9%	0.004	0.952	6	46.2%	24	35.8%	0.496	0.481
Female	32	62.7%	18	62.1%			7	53.8%	43	64.2%		
Level of education												
Nursing diploma	6	11.8%	5	17.2%	2.316	0.509	2	15.4%	9	13.5%	1.600	0.659
Nursing institute	18	35.3%	12	41.5%			6	46.2%	24	35.8%		
Nursing Bachelor	12	23.5%	3	10.3%			3	23.1%	12	17.9%		
Post graduate	15	29.4%	9	31.0%			2	15.4%	22	32.8%		
Years of experience												
1< year	8	15.7%	8	27.6%	2.173	0.537	4	30.8%	12	17.9%	1.915	0.59
1< 5 years	11	21.6%	7	24.1%			3	23.1%	15	22.4%		
5< 10 years	21	41.1%	10	34.5%			5	38.4%	26	38.8%		
10 > years	11	21.6%	4	13.8%			1	7.7%	14	20.9%		

Table (4): Relation between total nurses practices and their personal characteristics level pre/post an educational program. (N=80).

Items	Pre educational program. (N=80)				X^2	p-value	Post educational program. (N=80)				X^2	p-value
	Incompetent (N=68)		Competent (N=12)				Incompetent (N=18)		Competent (N=62)			
	No.	%	No.	%			No.	%	No.	%		
Age / years												
<20	16	23.5%	1	8.3%	3.267	0.352	4	22.2%	13	21.0%	0.019	0.999
20 < 25	14	20.6%	4	33.3%			4	22.2%	14	22.6%		
25< 30	20	29.4%	2	16.7%			5	27.8%	17	27.4%		
30> 40	18	26.5%	5	41.7%			5	27.8%	18	29.0%		
Gender												
Male	26	38.2%	4	33.3%	0.105	0.746	6	33.3%	24	38.7%	0.172	0.678
Female	42	61.8%	8	66.7%			12	66.7%	38	61.3%		
Level of education												
Nursing diploma	7	10.3%	4	33.3%	5.657	0.13	4	22.2%	7	11.3%	1.938	0.585
Nursing institute	28	41.2%	2	16.7%			6	33.4%	24	38.7%		
Nursing Bachelor	13	19.1%	2	16.7%			4	22.2%	11	17.7%		
Post graduate	20	29.4%	4	33.3%			4	22.2%	20	32.3%		
Years of experience												
1 <	13	19.1%	3	25.0%	1.761	0.623	5	27.8%	11	17.7%	1.574	0.665
1 <10 years	17	25.1%	1	8.3%			4	22.2%	14	22.7%		
5< 10 years	26	38.2%	5	41.7%			5	27.8%	26	41.9%		
10> years	12	17.6%	3	25.0%			4	22.2%	11	17.7%		

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Table (5): Relation between total nurses attitude level and their personal characteristics of studied pre/post an educational program. (N=80).

Items	Pre educational program. (N=80)				X^2	p-value	Post educational program. (N=80)				X^2	p-value
	Negative (N=36)		Positive (N=44)				Negative (N=14)		Positive (N=66)			
	No.	%	No.	%			No.	%	No.	%		
Age in years												
<20	7	19.4%	10	22.7%	0.505	0.918	3	21.4%	14	21.2%	0.016	0.999
20< 25	9	25.0%	9	20.5%			3	21.4%	15	22.7%		
25< 30	9	25.0%	13	29.5%			4	28.6%	18	27.3%		
30> 40	11	30.6%	12	27.3%			4	28.6%	19	28.8%		
Gender												
Male	17	47.2%	13	29.5%	2.64	0.104	5	35.7%	25	37.9%	0.023	0.879
Female	19	52.8%	31	70.5%			9	64.3%	41	62.1%		
Level of education												
Nursing diploma	5	13.9%	6	13.6%	6.489	0.09	1	7.1%	10	15.2%	2.823	0.42
Nursing institute	12	33.3%	18	40.9%			6	42.9%	24	36.4%		
Nursing Bachelor	11	30.6%	4	9.1%			1	7.1%	14	21.2%		
Post graduate	8	22.2%	16	36.4%			6	42.9%	18	27.2%		
Years of experience												
1< year	8	22.2%	8	18.2%	0.298	0.96	5	35.7%	11	16.7%	2.825	0.419
1< 5 years	8	22.2%	10	22.7%			2	14.3%	16	24.2%		
5 < 10 years	13	36.2%	18	40.9%			5	35.7%	26	39.4%		
10 > years	7	19.4%	8	18.2%			2	14.3%	13	19.7%		

Table (6): **Correlation between the study variable total knowledge, total practices and total attitude among studied nurses (N=80).**

Scale	Total attitude				Total knowledge			
	pre-program		post-program		pre-program		post-program	
	R	p- value	R	p- value	R	p-value	r	p- value
Total knowledge	0.224	0.046*	0.296	0.008*	-	-	-	-
Total practices	0.387	0.000**	0.209	0.062	0.200	0.075	0.902	0.000**

Highly statistical significance difference (P<0.000)

Discussion

Hypoglycemia is the most common metabolic disturbance in the neonatal age; it is one of the most common causes for admission to neonatal intensive care unit. Hypoglycemia is estimated to be more common in developing countries due to higher rates of low birth weight and intrauterine growth restriction (IUGR), as well as insufficient nutrition and inadequate treatment. A common problem in neonate care is screening at-risk neonate and controlling low blood glucose levels in the first hours to days of life **(Alsaleem & Kamat, 2019).**

The current study examined the personal characteristics of the nurses under investigation and discovered that, with a mean age of 33.51 7.21 years, more than a quarter of the nurses are between the ages of 30 and 40. Less than two thirds of the nurses under examination are female. This may be the result of the fact that the study's high percentage of female nurses demonstrated that nursing is a profession predominately held by female in Egypt and that these age ranges fit within the productive age range for the hospital workforce.

Similar results were reported by **Lee et al., (2020),** who did a study titled "Developing nursing standard guidelines for nurses in a neonatal intensive care unit" and discovered that, the majority of the nurses in the study were female and had an average age of 33.3 ± 5.2 years.

In the same context, **Joshi et al., (2018)** study on the "Preparedness of Nurses to Work in Neonatal Intensive Care Unit in a Selected Tertiary Care Facility" disagreed with the findings of the current study, which found that the studied nurses' ages ranged from 24 to 29 years. This mismatch can result from variations in the examined sample's features and various contexts.

According to the current study's findings, more than one third of the nurses of the study attended nursing school, more than one third of them had 5 < 10 years of experience, with a mean of 9.515.41 years, and all of them had not taken any training sessions

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on how to care for newborns who have hypoglycemia.

These findings were in line with those of a study conducted by **Hawi & Khudhair's ,(2021) ,** titled "Effectiveness of Health Educational Program on Nurse's Practices toward Care of Neonates with Hypoglycemia at Neonatal Intensive Care Unit in Al-Nasiriya City," who found that over one-third of the nurses in the study had had more than five years of NICU experience, and that nearly two-fifths of the nurses had nursing degrees.

In the same context disagreed with **West & Aitafo, (2020)** who conduct study about "Prevalence and Clinical Outcome of Inborn Neonates with Hypoglycemia at the Point of Admission as seen in Rivers State University Teaching Hospital, Nigeria" and reported the majority of the study participants held a "Diploma in Nursing" professional qualification and had less than five years of experience. This gap may be due to variations in the sociodemographic traits of the study participants and study locations.

The current study showed that, with a mean age of 13.17 4.11 days, less than half of the studied neonates were between 7 and less than 15 days old, and that more than half of them were male. These findings were partially supported by the findings of a study conducted by **Hendy et al., (2020)** titled "Evaluating Nursing Competency for Caring of High-Risk Neonates at Neonatal Intensive Care Unit," which revealed that the mean chronological age of the neonates was 12.27.4 days, but that more than half of them were female.

In terms of medical diagnosis, the study's findings also stated that less than three quarters of the studied neonates was the diagnosis of hypoglycemia. Furthermore, with a mean ±SD of 1.05±0.721, less than half of them weighed between 1 and less than 1.5 kg upon admission. Additionally, the mean ±SD 1.75±0.82 and current weight of nearly half of them were 1.5 < 2 kg. Partially paralleling the findings of this study was a study by **Ochoga et al., (2018),** who contacted the study titled "Prevalence of Hypoglycemia in Newborn at Benue State University Teaching Hospital, Makurdi, Benue State, Nigeria" to explain that less than half of the neonates in the study weighed less than 1500 g at admission and less than half of them still weighed less than 2000 g.

In the same context, the results of this study were in disagreement with those of **Mazari et al., (2020),** who found that 31.9% of the neonates in their research with the title "Hypoglycemia in Newborns with Risk Factors of Hypoglycemia" experienced hypoglycemia. The research investigator believes that variations in the settings and characteristics of the study population could be the reason for this disparity.

The results of the current study showed that fewer than 75% of the neonates under investigation were delivered by cesarean section. With a mean age of ±SD 38.14±2.16 weeks, less than two thirds of the neonates under investigation had LGA gestational weight, and nearly half were between 38 and 42 weeks gestational age.

On the other hand, a study by **Efe et al.,(2019)**, concerning "Neonatal hypoglycemia: prevalence and clinical outcome in a tertiary health facility in North-Central Nigeria" discovered that 51.8% of the

neonates that were examined were delivered vaginally. The results of the study were similarly consistent with those of **West & Aitafo, (2020),** who examined the clinical outcomes and prevalence of hypoglycemia in inborn neonates at the time of admission as reported by the Rivers State University Teaching Hospital in Nigeria. With a mean gestational age of 36.62 ± 2.49 weeks, 58% of the neonates in their study were between 37 and 42 weeks.

According to the current study, less than two thirds of the nurses who were studied had inadequate knowledge levels prior to the implementation of educational programs, but most of them had appropriate knowledge levels after the programs were put into place. According to the study investigator, this can be explained by the fact that nurses' overall expertise increased following the program's adoption.

The results of this study were in agreement with those of **Adam & Elssayed, (2022)**, who conducted a study in Bahrain and looked into "The Effect of Neonatal Training Programs on NICU Nurses' Knowledge and Practice in the Military and Police Hospitals of Khartoum State, Sudan." The results demonstrated that all NICU nurses had higher levels of knowledge both before and after completing neonatal training courses. Furthermore, after the educational session, there was a noticeably bigger improvement in the overall knowledge score (p 0.001). **Mazari et al., (2020)** showed that 44% of the nurses in their study did not have an adequate general grasp of hypoglycemia.

The current results also showed that, after the educational program was implemented, more than three quarters of the nurses in the

study had competent levels of practice, while the majority of them had incompetent levels of practice before.

A study by **Adam & Elssayed, (2022)** that found the pre-intervention practice of the nurses under observation changed to post-intervention at P= 0.006, corroborated this conclusion. When it came to providing care for babies, the training program's adoption significantly improved the level of practice for nurses working in NICUs.

Regarding the nurses' attitudes toward neonatal hypoglycemia, the present study's results revealed that, before the educational program was put into place, over half of them disagreed that the NICU had enough staff members to provide the care that is required, but after the program was put into place, over half of them agreed.

The majority of the surveyed nurses had a neutral attitude about neonatal hyperbilirubinemia, according to a study by **Mirze & Atrushi, (2019)** that assessed the knowledge and attitudes of newborn nurses concerning the condition. Their results agreed with what we had found. The age, experience, and attendance of training sessions of the study subjects may have an impact on this, according to the research investigator.

Regarding the overall attitude level of the nurses under study regarding hypoglycemia, the current study showed that while most of them had positive attitudes regarding neonatal hypoglycemia post-implementation of the educational program, less than half of them had positive attitudes regarding the condition prior to that time.

In contrast to the study's conclusions, a study by **Zamani et al., (2019)** evaluating

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the "Effect of web-based education on knowledge, attitude, and practice of nurses in neonatal intensive care unit" found no significant difference in the mean attitude scores between the web-based education group and the control group. According to the research investigator, the differences in the features of the study groups and study instruments could be the root of this discrepancy.

It was interesting to discover in the current study result that there was no statistically significant difference between the personal characteristics of the studied nurses and their overall level of knowledge about hypoglycemia pre/post program implementation. This finding pertains to the relationship between the personal characteristics of the studied nurses and their total knowledge level. This result was contradicted a study by **Baghlani et al., (2019)** on "Neonatal Intensive Care Unit Nurses' Perceptions and Knowledge of Newborn Individualized Developmental Care and Assessment Program".

The current study examined the relationship between the personal characteristics of the nurses under study and their overall practice level. It found no statistically significant differences between the personal characteristics of the nurses under study and their overall practice level prior to and following program implementation.

These findings were in line with those of **Ramdan et al., (2019),** who found no statistically significant relationship between the personal characteristics of practice nurses and their level of practice, in a study titled "Assessment of Nursing Practice Regarding

Neonates with Hyperbilirubinemia". However, **Hawi & Khudhair, (2021)** discovered a substantial difference in the age, educational level, and nursing habits of neonates with hypoglycemia at the pretest and posttest.

Regarding the relationship between the nurses' personal characteristics and their general attitude level, the current study discovered no statistically significant difference between the nurses' personal characteristics and their general attitude level before and after the program's implementation.

This result was partly in line with a study conducted by **Liyew et al., (2020)** which found that factors such as total years of experience and amount of training acquired were positively correlated with attitude. On the other hand, a different study conducted by **Mirza and Atrushi ,(2019)** found a strong relationship between the attitudes of nurses and other characteristics.

The results of the current study showed a highly statistically positive correlation between the total level of practices and attitude prior to program implementation, a statistically positive correlation between the total level of knowledge and practices among nurses, and a statistically significant positive correlation between the total level of attitudes among the nurses under study.

According to a study by **Zamani et al., (2019)** there was a favorable association between the practice and attitude of nurses both before and after the program was implemented. Which agrees with our findings in part. The study "Assessment of Nurses' Knowledge and Practice regarding Neonatal

Jaundice in Neonatal Intensive Care Unit at Suez Canal University Hospitals" by **Gerges et al., (2022)** found no statistical correlation between the total knowledge and total practice of the nurses under study. This finding contradicted the previous findings.

Furthermore, a study conducted by **Khanjari et al., (2019)** evaluated the "Knowledge, attitudes and practices regarding neonatal jaundice among caregivers in a tertiary health facility in Ghana" and discovered a statistically significant positive correlation between the general knowledge, attitudes, and practices of the nurses under study.

Conclusion

The current study's findings indicated that the research hypothesis is accepted. When compared to before the program, the educational program was successful in raising nurses' overall knowledge, proficiency, and attitude toward the care of newborns with hypoglycemia. Results showed that throughout the program phase, there was a statistically significant relationship between the knowledge, practice, and attitude of nurses and their characteristics. Furthermore, there was a positive statistically significant link found between the knowledge, practice, and attitude of nurses.

Recommendations

1. Emphasizing the importance of continuing in-service education for nurses regarding care of neonates with hypoglycemia to keep them up to date in knowledge, practice and attitude.

2. Providing orientation program for newly employed nurses about care of neonates with hypoglycemia.

3. Developing a simplified and comprehensive booklet including guidelines about nursing care for neonates with hypoglycemia at NICU and shoud be available.

4. The study should be replicated on large sample and in different hospitals settings in order to generalize the result.

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تأثير برنامج تعليمي على أداء الممرضين فيما يتعلق برعاية حديثي الولادة المصابين بانخفاض نسبة السكر بالدم داخل وحدات العناية المركزة

منار عنتر أمير سعيد   - حنان نبوي الأعصر - ياسمين عبد الغنى عبد الفتاح محمد

إن الجلوكوز هو مصدر الغذاء الرئيسي للجسم والمخ. عند الولادة وعند حرمان الجسم فجأة من إمداد الجلوكوز له ينخفض مستوي الجلوكوز في الدم مما يؤدى الى مضاعفات خطيرة بالمخ و تأخر في النمو, فشل في عضلة القلب ونوبات صرع. لذلك هدفت هذه الدراسة الي تقييم تأثير برنامج تعليمي على أداء الممرضين فيما يتعلق برعاية حديثي الولادة المصابين بانخفاض نسبة السكر بالدم داخل وحدات العناية المركزة. تم استخدام تصميم شبة تجريبي لإجراء هذه الدراسة. تم إجراء الدراسة في وحدات العناية المركزة في مستشفى الأطفال التخصصي ببنها التابعة لوزارة الصحة والسكان ومستشفى بنها الجامعي التابعة لوزارة التعليم العالي والبحوث. تم إجراء الدراسة علي عينة متاحة تتكون (٨٠) من الممرضين في المكان المذكور أعلاها وكذلك عينة غرضية تتكون من(٨٠) من الاطفال حديثي الولادة الذين يعانون من انخفاض السكر بالدم. أوضحت النتائج ان هناك فروق ذات دلالة إحصائية بين المستوى الكلي لمعرفة الممرضين الخاضعين للدراسة حول إنخفاض نسبة السكر بالدم عند الأطفال حديثي الولادة في الاختبار القبلي والبعدي. كما أوضحت وجود علاقة ارتباط معنوية عالية بين المستوى الكلي لممارسة الممرضين والمستوى الكلي لاتجاههن في الاختبار القبلي والبعدي. الاستنتاج: ان تنفيذ البرنامج التعليمى كان فعالا في تحسين مستوى معلومات وممارسات واتجاهات الممرضين تجاة رعاية حديثى الولادة المصابين بإنخفاض نسبة السكر بالدم داخل وحدات العناية المركزة. واوصت الدراسة التأكيد علي أهمية التطوير المستمر أثناء أداء عمل الممرضيين فيما يتعلق برعاية حديثي الولادة المصابين بانخفاض السكر بالدم لإبقائهم علي إطلاع دائم بالمعلومات والممارسات والإتجاهات.