Enhancing Pediatric Nurses' Performance Regarding Selected Non-Pharmacological Techniques to Alleviate Pain in Neonates: An Educational Program

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Abstract

Background: Non-pharmacologic interventions have been recommended to relief pain in neonates during procedures related to the acute pain of mild to moderate intensity. They have proven the efficiency and present low risks to neonates, as well as low operating cost concerning intensive care. **Aim of the study was** to assess the effect of an educational program on enhancing pediatric nurses' performance regarding selected non-pharmacological techniques to alleviate pain in neonates. **Research design:** Quasi-experimental research design was utilized in the present study. **The study** was carried out at the neonatal intensive care unit affiliated to Zagazig University Children's Hospital. **All available nurses** (no=44), were included in this study. **Two tools** were used for data collection 1) Structured interview questionnaire sheet, and 2) Observational checklist. **Results:** It was revealed that the highest percentage of nurses and all of them had an unsatisfactory and inadequate level of knowledge and practice regarding selected non-pharmacological techniques to alleviate pain in neonates before the implementation of the program (79.5% &100%, respectively). Meanwhile, after the implementation of the program, about two third and slightly less than half of nurses had satisfactory and adequate levels of knowledge and practice (68.2% & 47. 7%, respectively), with a statistically significance difference (p=0.000). **Conclusion:** Implementing the educational program had a significant positive effect on improving pediatric nurses' performance regarding selected non-pharmacological techniques to alleviate pain in neonates. **Recommendations:** Encouraging more periodical continuing in service education for pediatric nurses that empowering more successive utilization of non-pharmacological methods in clinical care with the need of follow up.

Key Words: Educational Program- Pediatric Nurses performance- Selected non-Pharmacological Techniques -Pain - Neonates.

Introduction:

A neonate is the baby in the first 28 days of life (**Hill, 2020**). Newborn infants admitted to a Neonatal Intensive Care Unit (NICU) undergo an average of 134 painful procedures within the first two weeks (**Valeri etal., 2015 & Cruz etal., 2016**). Even more concerning, some newborns might experience more than 3000 painful procedures during the entire course of their NICU stay (**Gaspardo etal., 2018**). These procedures are often necessary to ensure best care; such as heel pricks for blood sampling or endotracheal suctioning. Some of these procedures are also performed repeatedly on the same neonate and have been shown to cause adverse physiological consequences, such as hypoxemia, and bradycardia (**Ottawa Neonatal Pain Interest Group, 2015**).

There are myriad influences that contribute to the risk factors of potentially having neonates, who need the NICU. These influences include maternal factors, such as hypertension or a pregnancy with multiples; delivery factors, such as breech presentation or meconium; and baby factors, such as gestational age at birth or birth weight. All these factors combined play a role in the baby's potential need for expert care. However, the nurses serving in this ICU are specifically trained to work together in caring for the neonates in this area of the hospital (**Hagy, 2015**).

The concept of pain has been defined and explained from many dimensions. The International Association for the Study of Pain (IASP) defines pain as an unpleasant sensory

and emotional experience associated with actual or potential tissue damage **(IASP, 2011)**. Some studies state that pain is known as the fifth vital sign, and health professionals should monitor and manage it when caring for neonates **(Theodosopoulou etal., 2013 & Karabulut etal., 2016)**.

Multiple studies report poor outcomes in neonates with untreated pain that can have both short- and long-term consequences. Short-term effects of uncontrolled pain include changes in physiologic vital signs (e.g., oxygen desaturations and increased heart rate), increased catabolism from these physiologic changes, delayed healing time, and greater postoperative morbidity and mortality. Long-term effects of uncontrolled pain include impaired emotional bonding, developmental delay, and hypoactive/hyperactive response to pain, and stress. Because of the many negative sequence from uncontrolled pain in the neonates, proper assessment and treatment are imperative **(Victoria & Murphy, 2016)**.

Pain management refers to the use of nursing process, stage-assessment, planning, implementation and evaluation for the treatment of pain **(Noel, 2012)**. Pain management in the neonatal period should base on accurately identifying the presence of pain as the first step for its optimal management. The main goal of pain management in the neonate is the use of interventions to minimize its intensity and duration. Thus, helping neonates to reorganize and recover from this stressful experience. Pain treatment should occupy a prominent place within the activities in the neonatal intensive care unit. Consequently, prevention and control of pain should be a priority throughout the neonates' hospital stay **(Tamez & Enfermagem, 2013)**.

This becomes a challenge due to the impossibility of verbal communication between professionals and neonates. It is said that proper assessment of pain is important because, depending on the result, there is the decision-making, especially regarding the implementation of pharmacological and non-pharmacological measures as pain assessment requires professional skills and experience, plus knowledge **(Costa etal., 2017 & Sposito etal., 2017)**.

The multidisciplinary team, especially the nursing team, is responsible for the use of neonatal pain-relief strategies. Thus, assessing, preventing, and managing pain is important actions and should be considered during the care through the adoption of pharmacological and non-pharmacological strategies **(Araujo etal., 2015)**. Pharmacological strategies consider the use of drugs to treat and relieve pain. The pharmacological strategies are indicated for severe and intense pain usually caused by invasive procedures, prolonged, more complex; include the use of opioids, local anesthetics, and glucose intake at 25.0%, and others **(Committee on fetus, Newborn &Pain Medicine, 2016)**.

Non-pharmacological pain management refers to the use of drug-free methods to relieve pain and improve wellbeing. Non-pharmacological interventions have been recommended for relief and pain management during procedures related to the acute pain of mild to moderate intensity. They have proven the efficiency and present low risks to neonates, as well as low operating cost concerning intensive care **(Araujo etal., 2015)**. As well as international studies show that non-pharmacological methods are economical, tolerated well by neonates, and these methods have proven to be effective whether used alone or combined with pharmacological methods. These strategies are inexpensive, easily assimilated and implemented by the nurses, and have low or no risk of complication **(Baulch, 2010 & Walter-Nicolet etal., 2010)**.

There are several non-pharmacological interventions that have been recommended as efficacious to manage acute neonatal pain in the NICU during minor procedures. Non-pharmacological methods includes oral sweet solutions, acupuncture, non-nutritive sucking, breastfeeding, Kangaroo Care, swaddling, therapeutic massage, musical therapy, facilitated tucking, rocking and holding, multi-sensorial stimulation and modification of environmental stimuli, these methods can be used before and after the application of any painful procedure **(Ho etal., 2016)**. Evaluation of such care showed reduction in pain among neonates during medical or nursing procedures as measured by physical and behavioral outcomes **(Avneet etal., 2018)**.

The barriers encountered by pediatric nurses that prevent the provision of optimal non pharmacological pain management for neonates are considered as a vital importance in order to eliminate unnecessary pain experienced by them **(Polkki etal., 2010)**. This barrier includes; heavy workload/lack of time, lack of resources, lack of pain management policies to support and encourage the use of non-pharmacological methods, personal traditional cultural values of pain and pain relief, lack of knowledge regarding non-pharmacological methods, belief in inefficacy of this methods in pain relief, belief that parents should take the main role in the use of non-pharmacological methods, lack of parental support and cooperation in using non-pharmacological methods, belief that nurses' primary task is to administer pain medication for pain relief and lack of experience in using non-pharmacological methods **(Celebioglu etal., 2015)**.

Significance of the study:

Pain in neonates is a common phenomenon and all neonates are regularly exposed to pain early in their lives. Repeated pain in neonates has a cost attached as it causes neurodevelopment troubles, disabilities, behavior, and long-term cognitive, social, and emotional tasks that sometimes are irreversible. Nurses play a significant role in the NICU in providing pain assessment and treatment. Neonates are often more sensitive to adverse effects of medication due to the immaturity of many systems, including the renal, hepatic and central nervous systems. To avoid this effect, non-pharmacological pain intervention is used as a prophylactic and complementary approach to alleviate pain.

With the growing awareness of the importance of adequate neonatal pain management through using the non-**pharmacological** techniques in the past several years, very little researches have been conducted on this subject whether on the national and international levels, and non-pharmacological pain management in neonates is still an unevolved area in many countries, such as Egypt. Nurses have attended to pain concerns, as it is generally accepted that neonates cannot feel pain. Pain in neonates is thus neglected in hospitals, especially in the NICU.

Thus, the researcher decided to develop and implement an educational program to provide nurses with up-to-date information, equip them with better understanding and skills for managing neonate's pain effectively through using non-pharmacologic techniques and thereby improving the overall quality of care that decrease morbidity and mortality, in addition, to lessen the burden on families, hospitals, and the community as well.

Operational definitions:

Non-nutritive sucking (NNS): Non-nutritive sucking (NNS) refers to using a dummy with a neonate to promote sucking without breast or infant formula milk to provide nourishment **(De Freitas etal., 2012)**.

Kangaroo Care: Skin to skin contact is defined as the upright prone positioning of the diaper-clad neonate skin to-skin and chest-to-chest with caregivers during a painful procedure or for soothing after a painful procedure **(Flacking etal., 2011)**.

Rocking and Holding: Rocking is considered a gentle back and forth motion that stimulates a vestibular response. Holding is defined as the holding of a clothed infant by the care provider **(O'Brien etal., 2018)**.

Swaddling: Swaddling involves wrapping the neonate firmly in a cloth or blanket to make them feel secure (**Lago etal., 2014)**.

Aim of the study

To assess the effect of an educational program on enhancing pediatric nurses' performance regarding selected non-pharmacological techniques to alleviate pain in neonates.

Research hypotheses:

1- Pediatric nurses' knowledge regarding selected non-pharmacological techniques to alleviate pain in neonates will be improved after the implementation of the educational program.

2- Pediatric nurses' practice regarding selected non-pharmacological techniques to alleviate

pain in neonates will be improved after the implementation of the educational program.

3- The educational program will change nurses' perceptions of some barriers related to knowledge and experience in pain management, which limited their use of these methods.

Subject and Methods

Research Design: A quasi experimental design was used to conduct the present study.

Setting: The study was conducted at the Neonatal Intensive Care Unit (NICU) affiliated to Zagazig University Children's Hospital.

Subjects: The subjects of the present study included all nurses (no=44), who were available during the period of data collection in the previously mentioned setting and providing direct neonatal care regardless their characteristics and also willing to participate in the study.

Tools of Data Collection:

Two tools were used to collect data for this study.

The Tool I: Structured interview questionnaire sheet: It was developed by the researchers through reviewing the related literature **(Healthy Children Organization, 2013; Basavanthappa, 2015; Mottal & Cunha, 2015)**. It consists of three parts:

Part I: Characteristics of the studied nurses, including age, educational qualification, years of experience in NICU, marital status, and attending previous training courses concerning non-pharmacological techniques to alleviate pain in neonates.

Part II: To assess pediatric nurses' knowledge regarding selected non-pharmacological techniques to alleviate pain in neonates before and after the implementation of the program, it consists of 18 questions in the form of true and false and classified as follows; definition and benefits of non-pharmacological management, selected non- pharmacological techniques which were; non-nutritive sucking, skin to skin contact, holding and rocking, swaddling, and modification of environmental stimuli.

Scoring system for nurses' knowledge: The responses were one score for correct answers and zero for incorrect answers. The total score for each nurse was calculated and converted into a percent score by dividing the nurses' total score by the maximum possible score. The total scores were ranged from zero to 18. The level of knowledge score was satisfactory if the scores were equal and more than 75% and unsatisfactory if the scores were less than 75%.

Part III: It was adopted by the researchers from **PoIkki etal., (2010) and He etal., (2005)** to investigate the barriers that limited pediatric nurses' use of non-pharmacological techniques before and after the implementation of the program and contained 14 questions, which were scored on a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). The responses were dichotomized into two categories: "strongly agree/agree" and "strongly disagree/disagree/uncertain".

The Tool II: Observational checklist:

It was adapted by the researchers from **Basavanthappa, (2015)** and **Mottal & Cunha, (2015)** to assess the pediatric nurses' practices in applying selected non-pharmacological techniques to alleviate pain in neonates in different painful procedures in NICU before and after the implementation of the program which includes; nonnutritive sucking consists of 4 steps, skin to skin contact consists of 8 steps, holding and rocking consists of 6 steps ,swaddling consists of 10 steps, and modifying environmental stimuli consists of 3 steps.

Scoring system: The responses were done & not done, one score for done, and zero for not done, the total score for each nurse was calculated and converted into the percent score by dividing the total score by the maximum possible score. The total scores were ranged from zero to 31. The level of practice score was adequate if the score was equal and more than 85% and

the level of practice score was inadequate if the score less than 85%.

Reliability: The reliability of the tools of data collection was achieved through estimating its internal consistency which used Cronbach alpha coefficient. The reliability coefficient for the first tool was 0.91 and 0.88 for the second tool

Validity: The tools were tested for content validity by five experts (two professors of pediatric nursing, Faculty of Nursing, Cairo University, and three professors from Faculty of Nursing, Ain Shams University. The recommended modifications were done, and the final form was ready for use.

Educational Program: The educational program has been developed for the nurses working in neonatal intensive care unit by the researchers based on the result of pre-test and after reviewing the related literature. The objective of the program was to enhance the pediatric nurses' performance regarding selected non-pharmacological techniques to alleviate pain in neonates.

Field work:

Preparatory phase: During this phase, the researchers reviewed the local and the international literature using books, articles, periodicals, and magazines to get more knowledge about the study problem and also helped in designing the study tools for data collection.

Ethical Considerations: The study was approved by the Ethics Committee at the Faculty of Nursing; Zagazig University. The verbal explanation of the nature, purpose, and benefits of the study was performed by the researchers to the nurses included in the study sample. Oral consent was taken from the subjects who were reassured about the confidentiality and anonymity of the study. Nurses were informed about their right to refuse or withdraw from the study at any time without giving a reason.

Pilot study: After developing the tools, a pilot study was carried about 10% of nurses to test the clarity and applicability of the tools and to estimate the length of time needed to fill the tools. No modifications were done to the items of the tools. So, the nurses were included in the study sample.

Methods of data collection: The data were collected by two methods structured interview questionnaire sheet and observational checklist. Before collecting data from the study subject, it was necessary for the researchers to introduce themself and explain the purpose of the study for the subjects included in the study individually and as a group. After an explanation of the study aim, the interview questionnaire sheet was answered by the nurses at the time of day working. The time needed to fill the structured interview questionnaire sheet about 10-15 minutes. The researchers assessed the practice of nurses by using observational checklist in their clinical area. The average time required was around 15-20 minutes. The researchers were present at all the time for any clarification. Data collection was carried out during the period from the beginning of June to the end of August 2019. The researchers taught programming in the morning and afternoon shifts three days/ per week.

Implementation phase: The program designed for this study has been implemented through 7 sessions (of which 3 theory sessions covered the information about the definition, the benefits of selected non-pharmacologic techniques which included; non-nutritive sucking, skin to skin contact, holding and rocking, swaddling, modifying environmental stimuli & also mechanism of its action in alleviating pain in neonates. In addition to, 4 practical sessions included steps for the application of selected non-pharmacological techniques which involved: non-nutritive sucking, skin to skin contact, modifying environmental stimuli, holding and rocking, and swaddling.

These sessions lasted for 7 hours (one hour for each theoretical and practical session). Typically, the sessions were held about three days /week basis. The nurses were divided into 11 groups, and each group consisted of 4 nurses. Each group was trained three hours /three days /week, began with the theory session and took a rest then followed by the practical session. The total time of the program was 3 months. Educational program about non-pharmacological techniques to alleviate pain in neonates was included in a booklet and given to each participant. Methods of teaching were through a modified lecture, demonstration, re-demonstration and group discussion. Audiovisual material was also used to further explain some sessions.

Evaluation phase: The program evaluation was applied two times for nurses one before the program and the second occurred immediately after the completion of the educational program.

Administrative Design: An official permission was obtained by submission of formal letters issued from the Dean of the Faculty of Nursing, Zagazig University to the responsible authorities of the study setting to obtain their permission for data collection.

Statistical Analysis:

Data entry and statistical analysis were performed by using computer software, the statistical package for social sciences (SPSS), version 25. Suitable descriptive statistics were used such as: frequency, percentage, mean and standard deviation. Inferential statistics were used, the chi-square test, McNemar test for qualitative variables and paired t test, for quantitative variables. One way analysis of variance test (ANOVA) was used to analyze the difference between three or more continuous variables. In addition, the correlation coefficient (r) test was used to estimate the close association between the variables. Statistically significant difference was considered at a p-value < 0.05, a highly statistically significant difference was considered at a p-value < 0.001, while p-value > 0.05 indicated non-significant.

Results:

Table (1) illustrated that slightly more than half of nurses (54.6%) were 20 to less than 30 years, with a mean age 25.4±2.4 years. As regards the educational qualification of the studied nurses, it was found that near from half of nurses (45.5%) had a bachelor nursing degree and 59.1% of them were married. Concerning the nurses' years of experience, it was noticed that about the third of nurses (34.1%) had work experience in neonatal intensive care unit from one to less 5 years. The majority of the studied nurses (81.8%) did not attend any previous training courses about non- pharmacological techniques to alleviate pain in neonates.

Table (2) demonstrated that there was a highly statistically significant difference between the mean score of nurses' knowledge before and after the program implementation (p=<0.001).

Table (3) showed that Heavy workload/lack of time and lacks of in-service training (81.8% &79.5% respectively) were the most commonly reported barriers that limited nurses' application of the pain relief techniques pre-program implementation. Although, the results showed a decrease in the number of nurses, who stated that the following barriers had limited their use of non-pharmacological techniques after the program as, Heavy workload/lack of time (75%), lack of resources (59.1%), lack of experience in using non-pharmacological techniques(56.8%), lack of pain management policy to support and encourage the use of non-pharmacological techniques(45.5%) and lack of knowledge about non-pharmacological techniques(40.9%), there was an increase in the number of nurses who agreed that the other barriers had limited their use of the techniques without statistical significance. The third hypothesis was partially supported.

Total mean score of nurses' practice regarding selected non-pharmacological techniques to alleviate pain in neonates throughout the program phases was showed in **table (4)**. It was found that before the program implementation, none of the nurses used any non- pharmacological techniques, while after the implementation of the program the highest

mean score of non- pharmacological techniques most used by nurses was related to swaddling and skin to skin contact (17.54±1.41&16.4±1.1, respectively). Also, this table founded that there was a highly statistically significant difference between the mean score of nurses' practice regarding all non-pharmacological techniques before and after the program implementation (p=<0.001).

Levels of nurses' knowledge and practice regarding selected non-pharmacological techniques to alleviate pain in neonates throughout the program phases were presented in **table (5)**. Before the implementation of the program, all of the nurses and the highest percentage of them (100% &79.5%, respectively) had inadequate levels of practice and an unsatisfactory level of knowledge. After the implementation of the program, about two third of nurses and slightly less than half of them had a satisfactory level of knowledge and an adequate level of practice (68.2% & 47.7%, respectively) with a highly statistically significance differences (p=0.000).

The relation between nurses' knowledge levels and their characteristics throughout the program phases was showed in **table (6)**. It was found that there was no statistical significant difference between nurses' knowledge levels and their characteristics throughout the program phases (p=>0.05).

Table (7) showed that there was no statistically significant difference between the total mean score of nurses' practice and their characteristic before and after the program implementation (p=>0.05).

Correlation between the total mean scores of nurses' knowledge and practice regarding selected non-pharmacological techniques to alleviate pain in neonates throughout the program phases was illustrated in **table (8)**. It was found that there was no statistically significant correlation between the total mean scores of nurses' knowledge and practice throughout the program phases.

Table (1): Distribution of the Studied Nurses According to Their Characteristics (n=44).

Nurses' Characteristics	(N=44)	
	No	%
Age in year		
20-<30	24	54.6%
30-40	10	22.7%
More than 40 years	10	22.7%
Mean +SD	25.4±2.4	
Educational qualification		
Secondary nursing school diploma	14	31.8%
Technical Institute of Nursing diploma	10	22.7%
Bachelor Nursing Degree	20	45.5%
Marital status		
Single	14	31.8%
Married	26	59.1%
Divorced/widowed	4	9.1%
Experience in NICU/years		
Less than 1 year	7	15.9%
1- less than five years	15	34.1%
5- to less than 10	12	27.3%
10 or more	10	22.7%
Attending previous training courses about non-pharmacological techniques		
Yes	8	18.2%
No	36	81.8%

Table (2): Mean Score of Nurses' Knowledge Regarding Selected Non-pharmacological Techniques to Alleviate Pain in Neonates Throughout the Program Phases (n=44).

Knowledge	Pre- program Mean± SD	Post- program Mean± SD	Paired t-test	P- value
Definition of non- pharmacological management	18.3140±5.097	27.1644±5.483	10.31	<0.001**
Benefits of non- pharmacological management	5.0233±2.346	10.1047±2.346	14.52	<0.001**
Selected non- pharmacological techniques:				
Non-nutritive sucking	00.0±0.00	39.7060±8.540	7.75	<0.001**
Skin to skin contact	0.00± 0.00	3.1209±1.365	9.87	<0.001**
Holding & Rocking	1.8605± 1.236	3.1109±1.254	8.65	<0.001**
Modification of environmental stimuli	0.00±0.00	8.1035±1.125	12.32	<0.001**
Swaddling	1.8605± 1.236	3.2217±1.262	8.56	<0.001**

**Highly statistical significant at $p<0.001$

Table (3): Comparison of Nurses' Perceptions of Barriers Limiting Their Use of Non-pharmacological Techniques Throughout the Program Phases (n=44)

Barriers	Pre- program Strongly agree/ agree		Post- program Strongly agree/ agree		McNemar test, P- value
	No	%	No	%	
Heavy workload/lack of time	36	81.8	33	75.0	0.90
Lack of in-service training	35	79.5	36	81.8	1.00
Unwillingness of physicians	19	43.2	26	59.1	0.786
Lack of resources (e.g. equipment, materials)	29	65.9	26	59.1	0.243
Lack of experience in using non-pharmacological techniques	28	63.6	25	56.8	0.405
Lack of pain management policy to support and encourage the use of non-pharmacological Techniques	24	54.5	20	45.5	0.132
Personal traditional cultural values on pain and pain relief	23	52.3	26	59.1	0.755
A task-oriented work organization model	22	50.0	27	61.4	0.522
Lack of knowledge regarding non-pharmacological pain relief techniques	21	47.7	18	40.9	0.362
Belief that parents should take the main role in using non-pharmacological techniques	20	45.5	24	54.5	0.597
Belief that nurse's primary task is to administer pain medication for pain relief	23	52.3	28	63.6	0.500
Belief in inefficacy of non-pharmacological techniques in pain relief	12	27.3	13	29.5	1.000
Inability to recognize pain behaviors in neonates	13	29.5	15	34.1	0.700
Inability of nurses to assess pain	14	29.5	18	40.9	0.300

Statistical insignificant at $p >0.05$

Table (4): Total Mean Score of Nurses' Practice Regarding Selected Non-pharmacological Techniques to Alleviate Pain in Neonates Throughout the Program Phases (n=44).

Selected non-pharmacological techniques	Pre- program Mean± SD	Post- program Mean± SD	Paired t-test	P- value
Nonnutritive sucking	0.00±0.0	6.35±0.71	-15.389	<0.001**
Skin to skin contact	0.00±0.0	16.4±1.1	-23.552	<0.001**
Holding and Rocking	0.00±0.0	14.54±0.66	-19.552	<0.001**
Swaddling	0.00±0.0	17.54±1.41	-25.057	<0.001**
Modifying environmental Stimuli	0.00±0.0	4.21±0.54	-12.021	<0.001**

**Highly statistical significant at $p<0.001$

Table (5): Total Levels of Nurses' Knowledge and Practice Regarding Selected Non-pharmacological Techniques to Alleviate Pain in Neonates Throughout the Program Phases (n=44).

	Pre-program (n=44)		Post-program (n=44)		Chi-square	p-value
	No	%	No	%		
Level of knowledge						
Satisfactory (Scores 75% and more)	9	20.5%	30	68.2%	11.821	0.000**
Unsatisfactory (Scores less than 75%)	35	79.5%	14	31.8%		
Level of practice						
Adequate (Scores 85% and more)	0	0.0%	21	47.7%	10.711	0.000**
Inadequate (Scores less than 85%)	44	100 %	23	52.3%		

**Highly statistical significant at p<0.001

Table (6): Relation between Nurses' Knowledge Levels and Their Characteristics Throughout the Program Phases (n=44).

Nurses' characteristics	Satisfactory level of Knowledge			
	Pre-program		Post-program	
	N	%	N	%
Age in year				
20-<30	12	40 %	18	60%
30-40	6	42.9%	8	57.1%
More than 40 years	8	47.1%	9	52.9%
Chi-square and P-value	χ^2 1.49 p >0.05		χ^2 0.539 p >0.05	
Educational qualification				
Nursing Diploma	8	42.1%	11	57.9%
Technical Institute of Nursing	4	36.4%	7	63.6%
Bachelor Nursing Degree	9	37.5%	15	62.5%
Chi-square and P-value	$\chi^2$2.834 p > 0.05		χ^2 14.618 p > 0.05	
Marital status				
Single	8	44.5%	10	55.5%
Married	11	36.7%	19	63.3%
Divorced/widowed	3	42.9%	4	57.1%
Chi-square and P-value	χ^2 0.342 p > 0.05		χ^2 3.712 p > 0.05	
Experience in NICU/years				
Less than 1 year	2	28.6%	5	71.4%
1- less than five years	7	38.9%	11	61.1%
5- to less than 10	6	40%	9	60%
10 or more	3	33.3%	6	66.7%
Chi-square and P-value	χ^2 0.432 p > 0.05		χ^2 3.813 p > 0.05	
Attending training courses about non-pharmacological techniques to relive pain in neonates				
Yes	3	33.3%	6	66.7%
No	1	5.3%	18	94.7
Chi-square and P-value	$\chi^2$0.512 p > 0.05		χ2 0.255 p > 0.05	

Statistical insignificant at p > 0.05

Table (7): Relation between Total Nurses' Practice Mean Score and Their Characteristics Throughout the Program Phases (n=44).

Items of nurses' characteristic	Total nurses' practice mean score					
	Pre-program (N=44)			Post- program (N=44)		
	Mean ±SD	F-test/t	P-value	Mean ±SD	F-test/t	P-value
Age in year						
20-<30	5.1455±2.971			32.4182±6.967		
30-40	6.9032±4.414	2. 08	>0.05	28.7742±9.039	2.12	>0.05
More than 40 years	5.7534±3.836			31.6164±7.381		
Educational qualification						
Nursing Diploma	5.9231±2.289			28.2308±10.353		
Technical Institute of Nursing	5.1786±3.652	1.06	>0.05	30.7143±9.951	0.316	>0.05
Bachelor Nursing Degree	6.0690±3.621			31.2931±6.826		
Marital status						
Single	4.5714±3.081			33.9286±5.954		
Married	6.4815±2.621	1.28	>0.05	28.0370±9.104	2.47	>0.05
Divorced/widowed	6.1667±5.113			34.7500±5.479		
Experience in NICU/years						
Less than 1 year	4.8121±2.178			25.2206±8.242		
1- less than five years	5.0470±2.511	1.09	>0.05	28.2621±4.614	0.213	>0.05
5- to less than 10	3.1575±2.431			26.4121±5.731		
Attending training courses about non-pharmacological techniques to alleviate pain in neonates						
Yes	9.2500±2.981	0.650	>0.05	30.2083±8.345	0.417	>0.05
No	4.4355±2.911			31.4516±7.795		

Statistical insignificant at p >0.05

Table (8): Correlation between the Total Mean Scores of Nurses' Knowledge and Practice Regarding Selected Non-pharmacological Techniques to Alleviate Pain in Neonates Throughout the Program Phases (n=44).

Variables	Knowledge pre		Practice pre		Knowledge post		Practice post	
	R	P value	R	P value	R	P value	r	P value
Knowledge pre	-	-	.027	.583	-.075	.321	-.031	.804
Practice pre	.027	.583	-	-	-.016	.665	-.132	.200
Knowledge post	-.075	.321	-.016	.665	-	-	. .144	.230
Practice post	-.031	.804	-.132	.200	.144	.230	-	-

Correlation is significant at the 0.01 level (2-tailed).

Discussion:

Pain management among neonates presents a challenge to the clinical practice. Although neonates are able to process nociceptive stimuli, painful procedures are commonly performed in neonatal intensive care units without adequate treatment (**Cruz etal., 2016**). Repeated and untreated pain experiences during the hospitalization at such early stages of life might lead to neurodevelopmental and behavioral damage, with detrimental consequences over both the short and long term (**Gaspardo etal., 2018**).

Therefore, neonatal intensive care units must adopt effective pain assessment tools that consider multiple factors (gestational age and physiological and behavioral responses to pain). Thus, health care professionals, especially nurses face the dilemma of balancing the need for proper monitoring, testing, and treatment with the need to minimize neonatal pain (**Carter & Brunkhorst, 2017**). Certain non-pharmacological methods can efficiently decrease pain and discomfort due to routine care measures and minor procedures in preterm and term neonates (**Eriksson & Campbell, 2019**). These methods include breastfeeding,

nonnutritive sucking, swaddling, or facilitated tucking (gently maintaining the arms and legs in a flexed position), skin-to-skin contact, and sensorial saturation through massage, touch, voice, and smell **(Kim, 2020)**.

Hence, the current study aimed to assess the effect of an educational program on enhancing pediatric nurses' performance regarding selected non-pharmacological techniques to alleviate pain in neonates. With respect to the hypotheses introduced in literature review, the results of the present study supported the research hypotheses.

In the present study, slightly more than half of nurses were in the age group from 20 to less than 30 years old and about the third of them had current job experience in NICU from one to less than 5 years. These findings agree with the study of **Rajesh & Swamy, (2014)** who found that most of the nurses had current job experience less than 5 years, Also the study of **Nimbalkar etal., (2014)** who reported that the majority of nurses were in the age category from 20 to less than 30 years. While this finding disagrees with the study of **Costa etal., (2017)** who conducted a study about "Nurses' knowledge and practices regarding pain management in newborns" and found that the age of the neonatal nurses varied from 21 to 52 years with an average of 30.8 years.

The present study revealed that near from half of nurses had a bachelor's degree of nursing. These findings with the same line with **Mehrnoush etal., (2017)** who conducted a study in Iran about "knowledge and attitude of personnel, key factors in implementation of neonatal pain management in NICU" and found that, the majority of the participating nurses had a bachelors' degree of nursing. From the researcher's point of view, that the higher degree of nursing qualification always selected to work with the most vulnerable population like high risk neonates. Also, the nurses who work in neonatal care units better to be graduated from a college or university education in order to be prepared as a highly qualified and practical nurse.

In relation to the studied nurses' attainment of previous educational courses, the current study finding revealed that the highest percentage of nurses didn't attend previous training courses about non- pharmacological techniques to alleviate pain in neonates. In accordance with the findings of **El-sayed etal.,(2013)** who conducted a study about "establishing basic standards of nursing care protocol at neonatal intensive care unit" and reported that, most of the nurses did not attend the previous in-service training program related to neonatal care at NICU. On the other side, this finding contradicted with the study by **De Oliverira Soares etal., (2016)** about pain in the neonatal unit: the knowledge, attitude and practice of the nursing team and found that more than two thirds of neonatal nurses received training on non- pharmacological pain management of newborns. Also, recent study results done by **Collados-Gomez etal., (2018)** about "perception of neonatal nurses on pain management" confirmed that near half of the nurses had received specific training in non-pharmacological techniques to relieve pain in neonates. The researchers relay this to, lack of in-service education, continuous training and staff development in the study settings. Also, the nurses who receive specialized education and training can easily be able to gain capability in assessing and identifying neonates' health problems and deal with them effectively.

According to the present study findings, prior to conducting the educational program, the highest percentage of nurses had an unsatisfactory level of knowledge regarding selected non-pharmacological techniques to alleviate pain in neonates. Unsatisfactory level of nurses' knowledge might be attributed to nurses' neglect reading and updating their knowledge about neonatal pain management after graduation. Another possible reason might be the absence of any resources or programs for continued nursing education that are essential to upgrade and improve the nurses' knowledge. These results are in agreement with those of **Noghabi etal., (2014)** who cited an unsatisfactory level of knowledge about non-pharmacological management of pain in newborns between nurses. As well as, these findings are corroborated by the findings of previous studies of **Balouchi etal.,(2016); Cirik etal., (2017); Shorofi & Arbon, (2017)** who found that the nurses had a knowledge

deficit in relation to non- pharmacological techniques to relieve pain in newborns.

After the program implementation, the post-test had shown a highly statistically significant improvement in the nurses' total knowledge scores compared with the pretest phase of all selected non- pharmacological techniques to alleviate pain in neonates. About two third of nurses had a satisfactory level of knowledge that reflects the impact of conducting the educational program. This improvement was most likely attributed to the contents of the program which were based on nurses' identified needs and priorities, the simplicity of the language, and avoiding purely scientific terms that could have made the nurses reluctant to learn. While the improving knowledge is thus not enough – it also needs to be reinforced and supported over time. Therefore, the regular dissemination of updates non pharmacological pain management in newborn information is an essential component of other educational program. These results are consistent with those of **Aymar etal., (2014); Christoffel etal., (2016) & Dongara etal., (2017)** who reported that there was a statistically significant improvement in the score of knowledge of the nursing staff following conducting the educational program about non-pharmacological management of pain in newborns.

The finding of the current study reveals that heavy workload/lack of time and lack of in-service training were the most commonly reported barriers that limited nurses' application of the non- pharmacological techniques to alleviate pain in newborns both at pre- and post-tests. If hospital managers are to support nurses in using non-pharmacological techniques, then one of the challenges will be to reduce their workload. Following the educational program, few participants reported other barriers, including lack of time, resources, experience, pain management policy and knowledge limited their use of non-pharmacological techniques, although this did not reach statistical significance. These results may mean that the encouragement, knowledge and material provided in the program had some effects. This finding in line with the previous studies conducted by **He etal., (2010); Mohebi & Azimzade (2014); Efe etal., (2017) &**

Pasha etal., (2017) who showed that heavy workload/lack of time and lack of training were the main reasons that limited nurses' use of non-pharmacological techniques both at pre- and post-test.

According to the present study findings, prior to conducting the educational program, all nurses had inadequate levels of practice regarding some selected non- pharmacological techniques to alleviate pain in neonates and none of them used any non- pharmacological techniques. There are several explanations for these results, the highest percentage of nurses have not had the satisfactory level of knowledge to apply non-pharmacological techniques to alleviate neonate's pain, or they might have been more cautious about using certain methods, as these might not be a part of the routine care in the NICU. Nurses might not have been aware that these techniques could help reduce the neonate's pain. As well as, the majority of nurses had no receiving training regarding non- pharmacological techniques to alleviate pain in newborns.

From the researcher's viewpoint the reasons for nurses' lack of practice might be that a specific educational course on pain management was not offered at all levels for nurse education, and pain management was not one of the areas of interest in continuing education for nurses. If nurses would use a task-oriented approach to their work, adding pain management as a part of their routine work, this might be a helpful way to encourage them to implement pain relief measures. These results are in agreement with the findings of the previous studies of **Noghabi etal., (2014); Dames etal., (2016) & Mohamed etal., (2018)** who founded that nurses had inadequate levels of practice regarding non-pharmacological pain management methods in newborns.

As for nurses' practices at the post-test immediately after conducting the program, the results have revealed improvement in all areas of practice with a statistically significant difference from pre-test. The finding study revealed that slightly less than half of nurses had an adequate level of practices at the post-test which indicated the effect of applying the educational program because of nurses' willingness to learn although the improvement

was not enough. This might have been due to; the nurses had no sufficient time to assess and manage neonatal pain, work load and decreased number of staff nurses, no training and lack of protocols on neonatal pain assessment and management or, if found, not strictly following them; not knowing which pain relief interventions were effective in neonates and being busy with daily work routine.

This result is supported by other researches from different countries as the Iranian study done by **Mehrnoush etal, (2016)** who found that proper pain management was significantly correlated with adequate training. Also, this finding is in agreement with the study of **Abd El-Aziz etal, (2018)** who found that there was improvement in nurses' practice about non-pharmacological methods for neonate's pain after the implementation of the educational program compared to pre- test. Additionally, supported by the findings of the cross sectional survey done at Finland by **Polkhi etal, (2018)** about "Nurses' perceptions of pain assessment and management practices in neonates" and indicated that educational methods for nurses are needed to improve pain assessment and management practices.

Concerning nurses' practice regarding selected non-pharmacological techniques to alleviate pain in neonates, the present study found that the highest mean score most used by nurses was related to swaddling and skin to skin contact after the implementation of the program. This result is in harmony with several Egyptian researches done by **Abd El-Moniem & Morsy (2011)** about "The effectiveness of kangaroo technique on preterm infant's weight gain". By **El-Naggar etal., (2013a)** about "Effect of kangaroo mother care on premature infants' physiological, behavioral and psychosocial outcomes", and by **El-Naggar etal., (2013b)** about "Impact of neonatal nurses' guidelines on improving their knowledge, attitude and practice toward kangaroo mother's care", whose concluded that educational programs and guidelines were effectively improved neonatal nurses' practice about skin to skin contact.

In addition to this finding is consistent with the finding of the study conducted by

Chan etal., (2016) to investigate factors influencing the adoption of kangaroo mother care in different contexts, and with the study conducted by **Ramaiah, (2016)** to determine the knowledge and practices concerning the care of the mother kangaroo among post-natal mothers of premature babies in Indian rural centers, as both researchers found that the skin to skin contact is effective method to relief pain in newborn. While these results contradicted with the study by **Khalil etal., (2019)** who found that all of the studied nurses used nonnutritive sucking and oral sucrose methods during arterial puncture, cannulation, and injections after the educational program compared to pre -test.

When talking about Neonatal Intensive Care Units (NICUs) environment around the neonates, it is necessary to know that, the physical environment is an important component of developmental care **Hutchinson, (2017)**. Evidence found high sound pressure levels in the NICUs and inside the incubators and had indicated the harmful health effects of the newborns **Pinheiro etal., (2011)**. However, the noise level in the Egyptian NICU has exceeded the allowed international levels and noisy events have altered the physiological stability of premature babies. Accordingly, staff education is recommended to eliminate noise pollution with its harmful effects in the neonates **Hassanein etal., (2013)**. Therefore, the present study focused on that issue and resulted in the findings related to the nurses' practices regarding the modification of environmental stimuli in the form of controlling environmental noise and light at NICU.

The finding of the current study reveals that the least frequently used techniques by nurses was related to modifying environmental stimuli in NICU after implementation of the program, although there is a significant difference between pre and post- tests. This result is coordinated with the finding of **Carvalhais etal., (2015)** in the study about "is there sufficient training of health care staff on noise reduction in neonatal intensive care units?" that it found a significant difference between nurses' practices before and after the program implementation. This finding is also consistent with the Egyptian study conducted

by **El-Ziady etal., (2017)** that gave the same result. While this finding contradicted with the study carried out by **Maciel etal., (2018)** who reported that the most frequently used non-pharmacological measures to relief pain in newborn by nurses which nesting positioning & environment control through the reduction of brightness and noise.

The finding of the current study shows that there was no statistical significant difference between nurses' knowledge levels, practice score regarding selected non-pharmacological techniques to alleviate pain in neonates and their characteristics throughout the program phases. The explanation for this study might be due to that the knowledge and practice of nurses are influenced by others variables rather than their characteristics some of which intrinsic variables, such as personal values and beliefs, and extrinsic variables, such as the physical environment, staffing resources, and interpersonal relationships between healthcare professionals, patients and families.

These findings are correspond with **Wysong, (2014)** which conveyed that there were no significant differences in mean scores for nurses' practices based on the educational preparation. Also the study of **Mohamed etal., (2018)** who found that there was no statistical significant differences between the nurses' practice score and their personal characteristics throughout the program phases. In Contrary **Freitas etal., (2014) & Noghabi etal., (2014)** concluded that there was a significant relationship between nurses' knowledge scores and their personal characteristics. Again the study by **Kostak etal., (2015)** assumed that level of education affects nurses' pain-relief practices. Level of knowledge of nurses also showed a measurable relation with attendants' learning in the study of **Rahman & Al-Mosawi (2017)**.

Moreover, the results of the current study revealed that there was no statistical significant correlation between nurses' knowledge and practices regarding selected non-pharmacological techniques to alleviate pain in neonates throughout the program phases. From the present study, the researchers had generally noticed that the staff nurses had a remarkable increase in the knowledge in post- test when compared to their preprogram knowledge. Also, there was an improvement in their total practice, but, not in the same level of the knowledge improvement. This numerical difference between the knowledge and practice score of this study was indicating that who had a satisfactory knowledge was not sufficient to perform adequate practice skill. The researchers pointed out that a greater increase in knowledge and application could occur with repeated information. Therefore, the regular dissemination of updates non pharmacological pain management information is an essential component of educational programs.

This finding contradicted with the study by **Aymar etal., (2014)** who concluded that the nurses involved in the educational intervention, perceived changes in their knowledge regarding non-pharmacological methods to alleviate pain in newborn at the unit and correlated them to strategies that were defined and implemented in the program. Also the study of **Mohamed etal., (2018)** who found that there was a moderate correlation between nurses' knowledge and practices regarding non-pharmacological methods for relief pain in newborn in the post-test phase.

Conclusion:

Based on the results of the study, it can be concluded that implementing the educational program had a significant positive effect on improving nurses' performance regarding selected non-pharmacological techniques to alleviate pain in neonates. Hence, the study aim was achieved and the research hypothesis was supported.

Recommendation:

Based on the study results, the following recommendations are suggested:

1- Encouraging more periodical continuing in service education for pediatric nurses that empowering more successive utilization of non-pharmacological methods in clinical care with the need of follow up.

2- Simple illustrated Arabic booklets about non- pharmacological techniques to alleviate pain in neonates should be accessible in all NICUs.

3- Hospital managers should motivate and support nurses in using non-pharmacological techniques inside the NICUs.

4- Replication of this study with a larger sample size at various neonatal intensive care units and with longitudinal follow-up in order to generalize the results.

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