

Upgrading pediatric nurses' knowledge and practice of neonatal pain assessment through in-service educational program

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Abstract: Background: Assessment of pain is a critical step to providing good pain management. Lack of pain assessment is one of the most problematic barriers to achieving good pain control. Neonatal pain assessment, measurement, and documentation are a challenge among many neonatal intensive care units (NICU). **Aim of the study:** to evaluate pediatric nurses' knowledge and practice of neonatal pain assessment through in-service educational program. **Research design:** A pre/ post quasi-experimental research design was utilized in the present study. The study was carried out at Pediatric & Obstetric Hospital-Minia University and General Hospitals at neonatal care units. A convenient sample of 41 nurses was included in this study. Educational program for nurses was done through using the following data collection tools 1) Pre-designed questionnaire sheet, 2) Observation checklists sheet and 3) Educational and training program. **Results:** It was revealed that there was an obvious increase in the total score of pediatric nurses' knowledge and practice in post and follow up program phase compared with pretest phase, with a very highly significant difference ($p < 0.001$). There was statistical relation between pediatric nurses' knowledge and their personal characteristics regarding pain assessment ($p < 0.001$). There were statistical relations between pediatric nurses' practice and their personal characteristics regarding pain and pain assessment tool ($p < 0.001$). **Conclusion:** The education program had a significant impact on pediatric nurses' knowledge and practices regarding of neonatal pain and pain assessment. **Recommendations:** More attention must be paid to pain assessment and control especially neonatal pain in the curriculum for all categories of nursing students.

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Key Words: Pediatric nurses' knowledge - neonatal pain assessment -educational program

1. Introduction:

An infant admitted to the Neonatal Intensive Care Unit (NICU) or Special Care Nursery (SCN) undergoes an average of 14 painful procedures a day (**Ottawa Neonatal Pain Interest Group, 2015**).

Pain is a universal experience. It is one of the oldest symptoms in the history of medicine; it is an unpleasant sensation that everyone is going to experience throughout life, and that can be aggravated by a disease or during certain procedures performed in hospital stays. (**Dames, et al., 2016**)

Pain assessment is often a subjective evaluation by health care professionals directly caring for infants which has the potential to heavily influence the management of pain in the neonatal setting (**Wallace & Jones, 2017**). Nurses play a key role in assessing a newborn's pain level. Pain is considered the "fifth vital sign" and should be assessed as frequently as the other four vital signs (**Ricci, 2007**). Newborns should be assessed for pain routinely, and before and after procedures, by care givers who are trained to assess

pain using multidimensional tools (**Cloherly, et al., 2012**).

Current practice requires the nursing staff to make a global pain assessment of neonates or apply validated pain scoring methods before taking appropriate actions to ameliorate newborn pain or discomfort (**Hall & Anand, 2014**). Differentiation between pain and irritability or agitation is a challenge. Agitation is a behavioral symptom of many problems, including environmental overstimulation, respiratory insufficiency, neurologic irritability and pain (**Gardner, et al., 2012**).

Infant pain assessment includes knowledge of the pain source/sources (including the length of time exposed to the source and type of stimulus), the ability of the infant to respond to the noxious stimulus and the clinician's judgment of the infant's pain (**Hatfield & Ely, 2015**). Assessment of neonatal pain is influenced by the attitudes and beliefs of care providers, amount of time spent observing for and having knowledge of pain responses, discrepancy

between attitudes and practice, knowledge and education of parents and professionals about pain and prioritization of pain recognition and relief in the NICU and the social community (**Gardner, et al., 2012**).

Pain needs to be assessed before treatment, but neonatal pain assessments are time- and labor-intensive and difficult to implement in routine NICUs care. Assessments of the continuous pain that follows invasive procedures, or inflammation and surgery, may enhance the quality of pain management, avoid untreated pain vs. unnecessary analgesia, prevent under- or overdosing of analgesics, or development of drug tolerance (**Anand, et al., 2017**).

A pain response can be interpreted in three phases: baseline, reactivity, and recovery. A pain response can be evaluated by pain reactivity and pain recovery. Reactivity indicates a change of reaction, from the baseline to post pain stimulus, whereas pain recovery indicates the duration of recovery from the time of reaction to a painful stimulus back to the baseline level (**Shu, et al., 2014**). Assessment of pain in the neonate is complicated by the inability of neonates to verbalize pain. Thus, while self-reporting is the single most reliable indicator of the existence and intensity of acute pain, indirect measurement including hormonal, behavioral, physiological measures have been used to validate pain in the neonate (**Abd El-Aziz, 2011**).

The four objectives in the assessment of pain are detecting the presence of pain, assessing the impact of pain, providing pain relieving interventions and evaluating the effectiveness of the intervention (**Gardner, et al., 2012**). Neonatal pain should be assessed routinely using context-specific, validated and objective pain methods (**Hall & Anand, 2014**). Pain assessment should be performed on the right patients, at the right time and with the right purpose to serve as a rationale for the right type of pain relief (**Ozawa & Yokoo, 2013**).

Significance of the study:

All newborns experience acute episodic pain or prolonged, continuous pain during admission to NICUs. In this context it was reported that about 379 neonates were admitted to Pediatric and Obstetric Hospital-Minia University and about 573 neonates to Minia General Hospital during the first half of 2017 at neonatal units. Premature and high-risk neonates receiving care in NICU are subjected to many painful procedures, including heel stick, venipuncture, and suctioning (**Min, et al., 2017**). and (**Anand, et al., 2017**).

The results of some studies demonstrate that there is still a gap between scientific knowledge on neonatal pain, as well as its consequences, and the use of methods for pain assessment and management

(**Aymar, et al., 2014**). Therefore developing and applying educational program for nurses about pain assessment in the neonatal units are very important to providing pain relieving interventions and evaluating the effectiveness of the intervention.

Aim of the study:

Aim of the study was to evaluate pediatric nurses' knowledge and practice of neonatal pain assessment through in-service educational program.

Research hypotheses:

1. Pediatric nurses' knowledge scores regarding pain assessment in neonates in post-test will be higher than in pre-test.
2. Pediatric nurses' practice scores regarding pain assessment in neonates in post-test will be higher than in pre-test.

2. Subjects and method:

Research Design:

This study was conducted using a pre/post Quasi-experimental research design.

Subjects:

A convenient sample of 41 nurses (14 nurses from Pediatric & Obstetric Hospital-Minia University and 27 nurses from Minia General Hospital).

Setting of the study:

This study was conducted at Pediatric & Obstetric Hospital-Minia University and Minia General Hospital at neonatal units.

Tools of data collection:

Two tools were developed by the researcher for collecting data which are:

Tool I: A structured interview questionnaire sheet. It was developed by the researcher after reviewing of the related literature in a simple Arabic language. Tool I consists of two parts:-

- Part (1): Personal data of nurses includes sex and age of nurses, qualification, years of experience... etc.

- Part (2): Knowledge assessment sheet (Pre\Post\Follow up test) about pain was adapted from (**Mahfoz, 2008; Srouji, et al., 2010; Bowden & Greenberg, 2012; Hockenberry & Wilson, 2015**).

Tool II: Observational checklist (Pre\Post\Follow up test) was adapted from (**Datta, 2009; World Health Organization, 2009; Motta I & Cunha, 2015; Basavanhappa, 2015; Healthy children org, 2017**) to assess the nurses' practices including: pain assessment tools as CRIES scale is an acronym of five parameters are **C**rying, **R**equires **O**xygen, **I**ncreased **V**ital Signs, **E**xpression **S**leeplessness and the neonatal infant pain scale (NIPS) looks at Six parameters are measured: facial expression, cry, breathing patterns, arm, leg and state of arousal.

Scoring system

Nurses' knowledge: a score of one was given for right answer and a zero for incorrect answer. The

nurses' knowledge was considered satisfactory if the percent score was 60% or more and unsatisfactory if scored less than 60%.

Nurses' practice: a score two done completely, one done incompletely and zero not done. The nurses' practice was considered proper if the percent score is 60% or more and improper if scored less than 60%.

Pilot study

A pilot study was conducted on 4 nurses (10% of the total sample) to test clarity, completeness and to determine the time involvement. Results of the pilot study illustrated that no refinements and modifications needed so the subjects were included to the actual sample.

Tools Validity:

The tool was tested for its content validity by a jury of five experts in the field of the study and necessary modifications were done. Content validity index (CVI) was 0.85 and 0.78 for tool I and II, respectively.

Tools Reliability:

Reliability of the tools was performed to confirm its internal consistency by using Cronbach's alpha test. The reliability scores of the tools was 0.87, which indicated internal consistency of the used tools.

Ethical Considerations:

A written initial approval was obtained from the research ethical committee of the faculty of nursing, Minia University. The purpose of this study was explained for every nurse and each nurse has right to agree or refuse participation in the study. Oral informed consent was obtained from nurses who participated in this study. They also informed that the information obtained will be confidential and will be used only for the purpose of the study. Each assessment sheet was coded and nurses' names did not appear on the sheets for the purpose of anonymity and confidentiality.

Procedure:

An official permission to conduct the proposed study was obtained by the researcher from the manager of Pediatric and Obstetric Hospital-Minia University and Minia General Hospital. Also, the official approval for data collection was obtained from the medical consultant of the study setting after explanation of the purpose of the study.

Once the permission was obtained to conduct the study, the researcher initiated data collection.

Collection of data was started from the beginning of June 2017 to the end of August 2017, through six days weekly during 2 shifts (morning and afternoon shifts). Nurses are divided into 10 groups according to work and place conditions, each group consisted of 4 nurses except one group which consisted of 5 nurses.

The theoretical content included information about pain (definition, causes, clinical manifestations, assessment (NIPS & CRIES scales), and role of nurse toward pain relief methods in neonate). The practical content included clinical application of the pain assessment tools (NIPS & CRIES scales).

Educational information and training practices about pain assessment and pain relief methods in neonates were included in a booklet and given to each participant. Post-test was conducted immediately after application of the program sessions for each group by interviewing and observing each participant alone. A follow-up test was conducted 3 months later in the same manner of posttest.

Limitations/difficulties of the study:

1. Workload of nurses was an obstacle as the researcher was waiting for a long time to start the session with participants, also this caused some participants to be tired to listen and had low concentration and need continuous repetition, which required a lot of time and effort.

2. Interruptions by other staff members during conducting sessions was also a limitation which caused sessions to stop more than once and required more time.

Statistical analysis of data:

Data were collected, revised, verified, coded, then entered PC for statistical analysis done by using IBM SPSS statistical package version 20. Data were analyzed and expressed using descriptive statistics, for qualitative data: number (N) and percentage (%), for quantitative data: mean (\bar{x}) and standard deviation (SD) and Kolmogorov-Smirnov for normality test was used to differentiate between parametric data and non-parametric data.

3. Results:

Table (1) presents total score of pediatric nurses' knowledge regarding pain assessment. An increase in the score in all knowledge areas was observed at the post and follow up program phase compared with pretest phase.

Table (1): Total Score of Pediatric Nurses' Knowledge regarding Pain assessment (n=41)

	Nurses' knowledge		Follow up	P-value from pre program
	Pre program	Post program		
Satisfactory	0 (0%)	41 (100%)	41 (100%)	<0.001
Unsatisfactory	41 (100%)	0 (0%)	0 (0%)	

- Dependent Quantitative data by Wilcoxon sign ranked test.

Table (2) demonstrates frequency distribution of pediatric nurses' practice regarding neonatal CRIES scale. It was found that there was an increase in practice scores in all practice areas at the post and follow up program phase compared with pretest phase. There was a significant increase in "evaluation of infants using all variables", as it was done correctly by about (0%) of nurses in pretest, while (92.6%) in

posttest and (78%) in follow up with a very highly significant difference from the pretest ($p < 0.001$). With regards to "setting a score for each variable", it was done correctly by about (0%) of nurses in pretest, while (97.5) in posttest and (68.2%) in follow up with a very highly significant difference from the pretest ($p < 0.001$).

Table (2): Frequency Distribution of Pediatric Nurses' Practice regarding Neonatal CRIES Scale (n=41)

	Pre	Post			Follow up			P-value
	Freq.	ND (%)	DI (%)	DC (%)	Freq.	DI (%)	DC (%)	
Check medical diagnosis and procedures done for baby.	41(100)	2 (4.8)	12 (29.2)	27 (65.8)	8 (19.5)	19(46.3)	14 (34.1)	<0.001
Determine if baby takes any medications that will affect his/her sensory perception to pain.	41(100)	2 (4.8)	9 (21.9)	30 (73.1)	15 (36.5)	13(3.7)	13 (31.7)	<0.001
Identify the variables listed in CRIES.	41(100)	0 (0)	4 (9.7)	37 (90.2)	0 (0)	18(43.9)	23 (56.1)	<0.001
Determining possible numerical values for each variable.	41(100)	0 (0)	3 (7.3)	38 (92.6)	0 (0)	11(26.8)	30 (73.1)	<0.001
Evaluation of infants using all variables.	41(100)	0 (0)	3 (7.3)	38 (92.6)	0 (0)	9 (21.9)	32 (78.04)	<0.001
Set a score for each variable.	41(100)	0 (0)	1 (2.4)	40 (97.5)	0 (0)	13 (31.7)	28 (68.2)	<0.001
Documentation of the total grades.	41(100)	0 (0)	12 (29.2)	29 (70.7)	3 (7.3)	28 (68.2)	19 (46.3)	<0.001
Repeat each hour for the first 24 hours after surgery.	41(100)	5 (12.1)	13 (31.7)	23 (56.1)	22 (53.6)	18 (43.9)	1 (2.4)	<0.001

Mc-Nemar test for comparison of paired qualitative data. Wilcoxon signed rank test for paired quantitative data.

*ND=Not Done *DI=Done Incorrectly *DC=Done Correctly.

Table (3) demonstrates frequency distribution of pediatric nurses' practice regarding neonatal NIPS scale. It was found that there was an increase in practice scores in all practice areas at the post and follow up program phase compared with pretest phase. There was a significant increase in "identifying the variables listed in NIPS", as about (0%) of nurses done it correctly in pretest, while (100%) in posttest

and (68.2%) in follow up phase with a very highly significant difference from the pretest ($p < 0.001$). With regards to "setting a score for each variable", it was done correctly by about (0%) of nurses in pre-test, while (100) in post-test and (70.7%) in follow up, with a very highly significant difference from the pre-test ($p < 0.001$).

Table (3): Frequency Distribution of Pediatric Nurses' Practice regarding Neonatal NIPS Scale (n=41)

	Pre	Post		Follow up			P-value
	Freq.	DI (%)	DC (%)	Freq.	DI (%)	DC (%)	
	ND (%)	DI (%)	DC (%)	ND (%)	DI (%)	DC (%)	
Check medical diagnosis and procedures done for baby.	41 (100)	4 (9.7)	37 (90.3)	2 (4.8)	15 (36.5)	24 (58.5)	<0.001
Determine if baby takes any medications that will affect his/her sensory perception to pain.	41 (100)	2 (4.8)	39 (95.2)	0 (0)	11 (26.8)	30 (73.1)	<0.001
Identify the variables listed in NIPS.	41 (100)	0 (0)	41 (100)	0 (0)	13 (31.7)	28 (68.2)	<0.001
Determining possible numerical values for each variable.	41 (100)	1 (2.4)	40 (97.6)	0 (0)	12 (29.2)	29 (70.7)	<0.001
Evaluation of infants using all variables.	41 (100)	0 (0)	41 (100)	0 (0)	9 (21.9)	32 (78.04)	<0.001
Set a score for each variable.	41(100)	0 (0)	41 (100)	0 (0)	12 (29.2)	29 (70.7)	<0.001
Documentation of the total grades.	41 (100)	7 (17.7)	34 (82.3)	10 (24.3)	21 (51.2)	10 (24.3)	<0.001

- Mc-Nemar test for comparison of paired qualitative data.

Wilcoxon signed rank test for paired quantitative data.*ND=Not Done

*DC=Done Correctly.

*DI=Done Incorrectly

Table (4) indicates the relation between pediatric nurses' knowledge and their personal characteristics regarding pain assessment. It indicates an increase in knowledge scores in all knowledge areas at the post and follow up program phase. However, this increase

reached statistically significant difference between the nurses' age, educational qualification and years of experience and their knowledge with a very highly significant difference ($p < 0.001$) regarding knowledge pre/post program and follow up; respectively.

Table (4): The Relation between Pediatric Nurses' Knowledge and their Personal Characteristics regarding pain assessment (n=41)

Variable	Pre-program Knowledge		Post-program Knowledge		Follow up		p-value
	S	Uns	S	Uns	S	Uns	
	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	
Age							
21-30 years	0 (0)	36 (87.8)	36 (87.8)	0 (0)	36 (87.8)	0 (0)	<0.001
31-40 years	0 (0)	4 (9.8)	4 (9.8)	0 (0)	4 (9.8)	0 (0)	
More than 40 years	0 (0)	1 (2.4)	1 (2.4)	0 (0)	1 (2.4)	0 (0)	
Educational qualification in nursing							
Diploma	0 (0)	4 (9.8)	4 (9.8)	0 (0)	4 (9.8)	0 (0)	<0.001
Technical Institute	0 (0)	29 (70.7)	29 (70.7)	0 (0)	29 (70.7)	0 (0)	
Bachelor in nursing science	0 (0)	8 (19.5)	8 (19.5)	0 (0)	8 (19.5)	0 (0)	
Experience in pediatric nursing							
Less than 5 years	0 (0)	36 (87.8)	36 (87.8)	0 (0)	36 (87.8)	0 (0)	<0.001
6-10 years	0 (0)	1 (2.4)	1 (2.4)	0 (0)	1 (2.4)	0 (0)	
More than 10 years	0 (0)	4 (9.8)	4 (9.8)	0 (0)	4 (9.8)	0 (0)	
Previous take of any courses about pain assessment and pain relief methods in neonates							
Yes	0 (0)	1 (2.4)	1 (2.4)	0 (0)	1 (2.4)	0 (0)	<0.001
No	0 (0)	40 (97.6)	40 (97.6)	0 (0)	40 (97.6)	0 (0)	

Dependent Qualitative data by Mc-Nemar test. *F=Frequency

*S=Satisfactory

*Uns=Unsatisfactory

Table (5) indicates the relation between pediatric nurses' practice and their personal characteristics regarding pain and pain assessment. It indicates an increase in practice scores in all practice areas at the post and follow up program phase. However, this

increase reached statistically significant difference between the nurses' age, educational qualification and years of experience and their practice with a very highly significant difference ($p < 0.001$) regarding practice pre/post program and follow up; respectively.

Table (5): The Relation between Pediatric Nurses' Practice and their Personal Characteristics regarding pain and pain assessment tool (n=41)

Variable	Pre-program practice		Post-program practice		Follow up		p-value
	P	Imp	P	Imp	P	Imp	
	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	
Age							
21-30 years	0 (0)	36 (87.8)	36 (87.8)	0 (0)	36 (87.8)	0 (0)	<0.001
31-40 years	0 (0)	4 (9.8)	4 (9.8)	0 (0)	4 (9.8)	0 (0)	
More than 40 years	0 (0)	1 (2.4)	1 (2.4)	0 (0)	1 (2.4)	0 (0)	
Educational qualification in nursing							
Diploma	0 (0)	4 (9.8)	4 (9.8)	0 (0)	4 (9.8)	0 (0)	<0.001
Technical Institute	0 (0)	29 (70.7)	29 (70.7)	0 (0)	29 (70.7)	0 (0)	
Bachelor in nursing science	0 (0)	8 (19.5)	8 (19.5)	0 (0)	8 (19.5)	0 (0)	
Experience in pediatric nursing							
Less than 5 years	0 (0)	36 (87.8)	36 (87.8)	0 (0)	36 (87.8)	0 (0)	<0.001
6-10 years	0 (0)	1 (2.4)	1 (2.4)	0 (0)	1 (2.4)	0 (0)	
More than 10 years	0 (0)	4 (9.8)	4 (9.8)	0 (0)	4 (9.8)	0 (0)	
Previous take of any courses about pain and pain relief methods in neonates							
Yes	0 (0)	1 (2.4)	1 (2.4)	0 (0)	1 (2.4)	0 (0)	<0.001
No	0 (0)	40 (97.6)	40 (97.6)	0 (0)	40 (97.6)	0 (0)	

Mc-Nemar test for comparison of paired qualitative data. *F=Frequency

*P=Proper *Imp=Improper

4. Discussion:

Accurate pain measurement in the neonate has been a challenge among many NICUs. Infants in the NICU experience a multitude of acute and chronic painful events. Infants depend on their care providers to accurately assess, measure, and document behavioral and physiological cues to identify the presence of their pain, since they are incapable of verbal self-report of pain. Proper assessment of pain is the first step toward relieving pain. Therefore, the neonatal staff needs to have specialized knowledge, education, and pain measurement tools to be cognizant of physiological and behavioral responses neonates have to pain in order to intervene **Desai, et al., (2018)**.

After program implementation, the post-test had shown statistically significant improvement in the nurses' total knowledge scores ($P < 0.001$) compared with the pre-test phase and all nurses had a satisfactory knowledge in the post-test. The improvement in nurses' knowledge included almost areas of knowledge. These results are consistent with those of **Aymar, et al., (2014)**, **Sujatha, et al., (2015)**, & **Rajesh and Swamy, (2014)** who reported that there was a statistically significant difference in the score of knowledge of the nursing staff following conducting pain management educational program.

On the same approach, study **Dongara, et al., (2017)**, showed that nurses' knowledge towards pain effectively improved after receiving pain education with the difference in total knowledge scores between pre-test and post-test and follow up was significant. The effect of the present program is also similar to that of **Kingsnorth, et al., (2015)** who found that there were significant improvements in nurses' knowledge, and behaviors related to optimal pain care following adoption of the pain clinical practice guideline.

In contrary **Dowd, (2009)** stated that when the active learning pre-test and post-test groups were compared, the results indicated that there was no statistically significant change in scores ($t=0.879$, $p\text{-value}= 0.385$) when studying the impact of a pain management educational program on pediatric nurses' knowledge about pain management.

After three months follow up test, the present study revealed that the mean of nurses' knowledge total scores was slightly decreased, this indicated that the improvement in knowledge was slightly decreased three months after implementing the educational program but it is still very significant ($P < 0.001$) compared with the pre-test phase and all nurses had a satisfactory knowledge. This result may be explained by the fact that, knowledge retention is usually affected by the time. These findings are paralleled with those of **McNamara, et al., (2012)** that improvement in nurses' knowledge regarding pain was

most effective immediately after the pain education program. **Abozeid, et al., (2015)** also demonstrated that nurses exhibited lower knowledge scores in follow up phase than post phase. In the same line **Machira, et al., (2013)** reported that there were differences in nurses' knowledge scores between post and follow up phase but these differences were not significant.

These findings are in agreement with those of **Noghabi, et al., (2014)** whose study showed that nurses had a low level of implying an inadequacy in nursing practice in neonatal pain assessment and management. These results also concur with the findings of **Kholowa, et al., (2017)** who reported that most of the nurses' pain management skills were far from optimal. Also, **Dames, et al., (2016)** demonstrated that nurses exhibited incapability to assess and manage neonatal pain.

As for nurses' practices at the post-test immediately after conducting the program, the results have revealed a sharp improvement in all areas of practice with a statistically significant difference from pre/test ($p < 0.001$). The findings of the present study are coherent with that of **Aymar, et al., (2014)** in indicating that there was a significant improvement in nurses' skills towards patients' experience of pain following the educational program, including increased usage of the assessment tool.

In the current study, the post and follow up test had shown statistically significant improvement in the nurses' total knowledge and practices about pain and pain assessment and their personal characteristics. The age of nurses had no effect on their baseline pre/post/follow up education program of knowledge and practice. The results have indicated that knowledge and practice were better in the post and follow up test of all nurses of all age categories. These findings are in an agreement with **Nimbalkar, et al., (2014)** & **Dongara, et al., (2017)**, who found that age, does not play a role in how pain is perceived by nurses and improvement in the nurses' understanding of pain was not associated with age.

In the present study, all nurses were females and the majority of the studied nurses were in the age group from 21-30 years old and the majority of them have current job experience less than 5 years. These findings are corroborated by findings of **Rajesh and Swamy, (2014)** and **Nimbalkar, et al., (2014)** who reported that all participants were women and the majority of them were in the age category (21-30 years). The present study revealed that most of nurses have clinical institute and this finding is somewhat agree with **Huth, et al., (2010)** whose study revealed that the majority of nurses were having technical education.

This study states that (61%) of the studied sample are married and (39%) of them are single. Additionally, about 2.4% of the studied sample had taken courses about pain and pain relief methods in neonates. These findings are confirmed with that of **Sujatha, et al., (2015)** who reported that the majority of participants were married and almost all of them did not attend any previous courses about neonatal pain.

Considering the effect of educational qualification on nurses' knowledge, the findings of this study revealed that there was significant difference in knowledge total score (P. 0.019) in pre-test phase, as nurses with Bachelor in nursing science have higher scores. This may be related to pain may be previously studied in their course specification. These results concur with those of **Cong, et al., (2014)** as in their studies differences in education affect levels of nurses' awareness of infant pain management. In the same context **Noghabi, et al., (2014) & Freitas, et al., (2014)** concluded that there was a significant relationship between nurses' knowledge scores and the level of education, that nurses with more education had more knowledge. Level of education also showed a measurable relation with attendants' learning in the study of **Rahman and AL-Mosawi, (2017)** during the pre-test phase.

Education is necessary but not sufficient to change practice, and didactic continuing education alone does little to change practice behavior. There is little evidence that interprofessional education as compared to discipline-specific education improves evidence-based practice (EBP). Interactive education, used in combination with other practice-reinforcing strategies, has more positive effects on improving EBP than didactic education alone (**Madenski, 2014**).

Taking into account the relation between educational qualification and practice, it was found that there was no significant statistical difference between total practice scores of nurses of all educational categories in the pre-test and post-test phase. These findings are corresponding with those of **Wysong, (2014)** which conveyed that there were no significant differences in mean scores for practices based on educational preparation. In Contrary **Kostak, et al., (2015)** assumed that level of education affects nurses' pain-relief practices.

During the follow-up phase of the present study, there was a significant statistical difference between total scores of nurses' practice (P. 0.017) with higher score belonged nurses with Bachelor in nursing science. This may be due to continuing using what has been taught in daily practice. Also, some of them had an educational rule in the unit which requires recalling and being alert to nurses' practice.

After program implementation, the post-test had shown statistically significant improvement in the

nurses' total knowledge scores (P. <0.001) compared with the pre-test phase and all nurses had a satisfactory knowledge in the post-test. The improvement in nurses' knowledge included almost areas of knowledge. These results are consistent with **Rahman and AL-Mosawi, (2017)** who concluded that there was no measurable huge relationship between attendants' learning and their general data as educational preparation when an educational program for nurses was conducted.

Conclusion:

Based on the findings of the present study, it can be concluded that:

Pediatric nurses were lacking the necessary basic knowledge and practice related pain and pain assessment in neonates. A training program was developed based on needs assessment. Implementation of the program was associated with significant improvements of nurses' knowledge and practice in both immediate posttest and follow up three months later that was associated with some decline. In general, the program achieved the aims for which it was conducted and nurses knowledge and practices were shifted from negative to positive competency after receiving the educational program.

Recommendation:

- More attention must be paid to pain assessment and control especially neonatal pain in the curriculum for all categories of nursing students.
- Regular training sessions and workshops for nurses should be organized by official institutions on pain assessment and control.

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