



## Original Article

## Effect of educational program on pediatric nurses' knowledge and practice regarding selected nonpharmacological techniques to relieve pain in neonates

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## ABSTRACT

**Background:** Newborn infants have an increased sensitivity to pain and are more reactive to pain than older children and adults. Nurses play a crucial role in assessing pain, implementing and evaluating interventions to minimize neonatal pain using available resources especially nonpharmacologic techniques.

**Aim of the study:** to develop and apply an educational program on pediatric nurses regarding selected non-pharmacologic techniques to relieve pain in neonates.

**Research design:** A pre/post quasi-experimental research design was utilized in the present study. The study was carried out at Minia University for Obstetric and Pediatric 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 mean scores of knowledge and practice in post and follow up program phase compared with pretest phase, with a very highly significant difference ( $p < 0.001$ ).

**Conclusion:** The education program had a significant impact on pediatric nurses' knowledge and practices regarding selected nonpharmacologic techniques to relieve pain in neonates.

**Recommendations:** A continuous training and educational program should be planned and offered on regular basis for nurses regarding nonpharmacologic techniques to relieve pain in neonates.

## Introduction

Pain is a universal experience and 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. The American Pain Society (1995) has labeled it "the fifth vital sign" to emphasize the importance of assessing pain frequently and providing appropriate treatment. The goal is to encourage health care professionals to assess pain every time that temperature, pulse, respiration and blood pressure are assessed and to institute measures to manage time (Syan, 2014; Dames et al., 2016). It is extensively documented that newborn infants admitted to neonatal units are regularly exposed to painful experiences; both term, and preterm newborns experience pain and have the right to receive safe, efficient, and effective pain relief (Ottawa Neonatal Pain Interest Group, 2015; Wallace and Jones, 2017).

Pain is a complex phenomenon whose nature is, at best, elusive in the neonate. The rationalization for inadequate treatment of pain has resulted in unnecessary suffering for these fragile infants. Research has shown that the unchecked release of stress hormones by untreated pain may exacerbate injury, prevent wound healing, lead to infection, prolong hospitalization, and even lead to death. These fragile neonates are simply too sick to not have their pain treated. Healthcare professionals are responsible for influencing positive change in clinical practice about neonatal pain (Gardner et al., 2012).

All newborns undergo at least one painful procedure during their first few days of life as newborn screening and sometimes heel lancing for bilirubin (Ottawa Neonatal Pain Interest Group, 2015). All neonates are exposed to pain at levels ranging from trivial to excruciating even normal healthy neonates experience pain after birth related to heel lancing, venipuncture, vitamin K injection or intramuscular (IM) vaccination. However, although normal healthy neonates experience

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limited amounts of pain, premature or critically ill neonates are exposed to various painful procedures such as mechanical ventilation, suctioning, intravenous (IV) access for the nutritional supplement or drug administration, chest tube insertion or lumbar puncture (Jeong et al., 2014).

Newborn infants experience pain just as older children, however, clinicians' ability and approach to assessing and managing neonatal pain is inadequate and controversial. Pain management is a very important aspect of nursing care of the pediatric patient. Since 2001, pain management standards require that providers be educated in the assessment and management of pain and that they recognize the right of patients to appropriate assessment and management of pain (Stanley and Pollard, 2013).

Neonatal pain is an emotive issue and nurses can help alleviate pain and suffering through careful assessment and ensuring appropriate interventions are provided by having an understanding of the mechanisms of neonatal pain pathways, nurses should be able to demonstrate effective assessment skills which in turn contribute to best practice. It is envisaged that nurse who learns about pain in the newborn will be empowered to provide interventions to relief neonatal pain. Pain assessment and management remain controversial. There are many assessment tools available for acute pain; however, the assessment of pain remains underused in the neonatal intensive care and special care units (Boxwell, 2010). Nurses working in Neonatal Intensive Care Units are responsible for applying the best-proven pain reduction methods in the most effective ways (Kostak et al., 2015).

Pain control in Neonatal Intensive Care Unit (NICU) yet remains suboptimal which suggests a gap between research evidence and the translation of knowledge into clinical practice this highlights the importance of exploring the clinical feasibility of implementation of nonpharmacological intervention through translational research (Ho et al., 2016). Although there is a significant improvement from a decade ago, particularly with an increase in the use of nonpharmacological interventions, nevertheless, about one-third of procedures were unmanaged and furthermore, the longer an infant remains in the NICU, the more procedures they will experience (Fernandes et al., 2011).

Several nonpharmacological interventions have been recommended as efficacious to manage acute neonatal pain in NICU during minor procedures such as oral sucrose and/or pacifier, kangaroo care, and swaddling. Evaluation of such care showed reduction in pain among neonates during medical or nursing procedures as measured by physical and behavioral outcomes (Ho et al., 2016).

Nursing care of the infant with pain includes nursing assessment, nursing diagnosis, planning, interventions, and evaluation. Each step of this process must be individualized for each infant. A general understanding of the physiology of pain, factors that influence pain and effective pain management techniques can help to individualize the infant's plan of care. When assessing pain in infant, the nurse must be mindful that the infant's response to the painful stimulus may not be immediate (AboEl-Maged, 2011; Kyle and Carman, 2013).

In general the appearance of painful sequelae fact which requires the development of strategies directing health professional actions to its correct and adequate control. In this sense, nursing is an important element of teaching pain as the fifth vital sign, by applying specific care science interventions (Romanek and Avelar, 2014).

### Significance of the study

Pain in newborns is a common phenomenon and all infants are regularly exposed to pain early in their lives (Noghabi et al., 2014). All newborns experience acute episodic pain or prolonged, continuous pain during admission to NICUs (Anand et al., 2017). In this context it was reported that about 379 neonates were admitted to Minia University for Obstetric and Pediatric Hospital 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). In a study by Simons carried out on 151 neonates, an average of  $14 \pm 4$  painful interventions/day was recorded for the first 14 days of life (Noghabi et al., 2014).

Research has continued to demonstrate that neonates can detect, process, and respond to painful stimuli, and preterm infants may actually have a 30%–50% lower pain threshold than adults and a lower pain tolerance than older children (Cong et al., 2013). Untreated pain in neonates may result in increased morbidity and length of stay in the NICU, exaggerated responses to pain in later life, and altered psychosocial development (Sawires et al., 2014). Effective pain prevention and treatment have been recommended as the standard of care at NICUs nowadays, yet both pharmacologic and nonpharmacologic pain interventions are still underused (Cong et al., 2013).

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 (Wilson-Smith, 2011). Non-pharmacological pain intervention is a prophylactic and complementary approach to alleviate pain. A number of non-pharmacological therapies have shown to be effective in the management of mild to moderate pain in neonates (Noghabi et al., 2014). Kostandy, Anderson, and Good (2013) conducted an in-hospital randomized controlled trial among healthy, full-term newborns examining the impact of skin to skin contact infant cry time and consolability among infants receiving a hepatitis B vaccine within the first hour of life. Thirty-six mother-infant dyads were randomized to either routine (infant placed supine in bassinet) or skin to skin contact (prone on mother's chest) vaccine administration. Skin to skin contact infants had shorter cry times and calmed more quickly after vaccine administration (Hockenberry and Wilson, 2015).

Another prospective, randomized and controlled study compared the effectiveness of two non-pharmacological pain relief strategies – non-nutritive sucking and facilitated tucking with routine care in pre-term newborns. The study showed nonnutritive sucking and facilitated tucking reduced pain scores in the PIPP scale (Premature Infant Pain Profile) more effectively than routine care during the heel puncture, and non-nutritive sucking represented an even greater reduction in pain (Motta and Cunha, 2015).

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 nonpharmacologic techniques to relieve pain in the neonatal units are very important and beneficial in terms of quality of care to decrease morbidity and mortality, in addition, to lessen the burden on families, hospitals, and the community as well.

### Operational definitions

In our study nonpharmacological techniques were composed of four items:

1. **Kangaroo Care:** Skin to skin contact also called Kangaroo Care (KC) and is operationally defined as the upright prone positioning of the diaper-clad infant skin-to-skin and chest-to-chest with an adult.
2. **Nonnutritive sucking:** Nonnutritive sucking means any repetitive oral activity in which there is no response to food stimuli.
3. **Swaddling:** Swaddling is defined as securely wrapping neonates in a blanket to prevent their limbs from moving around excessively.
4. **Rocking and Holding:** Rocking, holding or both are defined as an infant is held or gently moved up and down or side to side (or both) by a care-giver.

### Aim of the study

This study aimed to:

1. Assess the pediatric nurses' knowledge and practices regarding selected nonpharmacologic techniques to relieve pain in neonates.
2. Apply the educational program on pediatric nurses regarding selected nonpharmacologic techniques to relieve pain in neonates.
3. Assess the effect of educational program on pediatric nurses' knowledge and practices regarding selected nonpharmacologic techniques to relieve pain in neonates.

#### Research hypotheses

1. Nurses' knowledge mean scores regarding selected non-pharmacological techniques to relieve pain in neonates in post-test will be higher than in pre-test.
2. Nurses' practice mean scores regarding selected nonpharmacological techniques to relieve pain in neonates in post-test will be higher than in pre-test.

#### Research design

A Pre/post quasi-experimental research design was utilized to meet the aim of this study.

#### Subjects

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

#### Setting of the study

This study was conducted at Minia University for Obstetric and Pediatric Hospital and Minia General Hospital at neonatal units. Minia University for Obstetric and Pediatric Hospital neonatal unit is located on the third floor and contains two rooms, the first room for septic cases with a capacity of 13 incubators and the second room for clean cases with a capacity of 9 incubators. Minia General Hospital neonatal unit is located on the third floor and contains only one room with a capacity of 20 incubators.

#### Tools of data collection

Two tools were developed by the researchers 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 consist 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 and post-test) about pain was developed by the researcher that was adapted from (Mahfoz, 2008; Srouji et al., 2010; Bowden and Greenberg, 2012; Hockenberry and Wilson, 2015).

**Tool II:** Observational checklist (Pre and post -test) was developed by the researchers that was adapted from (Healthy children org., 2013; Mottal and Cunha, 2015; Basavanthappa, 2015) to assess the nurses' practices including: (pain assessment tools as CRIES scale and the neonatal infant pain scale (NIPS), hand washing and non-pharmacologic techniques to relieve pain in neonatal units as (non-nutritive sucking, skin to skin contact with the mother (kangaroo care), rocking and holding and swaddling). CRIES scale consists of 8 steps, neonatal infant pain scale (NIPS) consists of 7 steps, Hand Washing consists of 11 steps, Nonpharmacologic techniques (non-nutritive sucking consists of 4 steps, skin to skin contact with the mother (kangaroo care) consists of 8 steps, rocking and holding consists of 6 steps and swaddling consists of 10 steps).

#### 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

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

#### Tools validity

The tool was tested for content validity by a jury of five experts in the field of the pediatric nursing and neonatology and necessary modifications were done. The tool was tested for internal consistency after developing the tools.

#### Tools reliability

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

#### 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 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' name did not appear on the sheets in the purpose of anonymity and confidentiality.

#### Procedure

An official permission to conduct the proposed study was obtained by the researcher from the manager of Minia University for Obstetric and Pediatric and General Hospitals. 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. Also verbal consent was obtained from each nurses participated in the study. Clarification of the nature and purpose of the study was done on initial interview with each nurse.

Collection of data was started from the beginning of June 2017 to the end of august 2017, every day except Friday during 2 shifts, the first shift is from (8am: 2pm), and the second shift is from (2pm: 8pm). Nurses are divided into 10 groups according to work and place conditions, each group consists of 4 nurses except one group which consists of 5 nurses. Each group was trained an hour per day, so the number of nurses who are interviewed per each day varies between (8–9 nurses) as one group per shift.

Total time of the program was 3 months, two groups are trained every 14 days (6 days\week), and total time of the educational program for each group was 14 h in a total number of sessions equal 14 sessions and each session takes about an hour, including 1 h for the editorial and

presentation of the topic, 6 h for theoretical content and 7 h for practical content.

The theoretical content included information about pain (definition, causes, clinical manifestations, assessment (NIPS & CRIES scales), management and role of nurse toward neonatal pain), information about selected nonpharmacological techniques; non-nutritive sucking, skin to skin contact with the mother (kangaroo care), rocking and holding and swaddling (definition, benefits, mechanism of action in relieving pain and steps for each of them). The practical content included clinical application of the pain assessment tools (NIPS & CRIES scales) and selected nonpharmacological techniques (non-nutritive sucking, skin to skin contact with the mother (kangaroo care), rocking and holding and swaddling).

Educational information and training practices about pain, pain assessment and selected nonpharmacological techniques to relieve pain in neonates were included in a booklet and given to each participant. Methods of teaching were through a modified lecture, demonstration and re-demonstration and group discussion. Post test was conducted immediately after application of the program by interviewing and observing each participant alone. A follow up test was conducted 3 months later at the same manner of posttest.

*Limitations/difficulties of the study*

1. Work load 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 has low concentration and need continuous repetition, which required a lot of time and effort.
2. Interruptions during conducting sessions by other staff members.

*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. The independent quantitative continuous data were compared by using Mann-Whitney *U* test. The dependent Quantitative continuous data were compared by data by Wilcoxon sign ranked test. The dependent Qualitative data were compared by McNemar test. ANOVA test was used to compare quantitative data with sample characteristics.

**Results**

Table 1 illustrates the personal characteristics of the studied nurses. It was found that the majority (87.8%) of them were ages 21–30 years, with a mean age  $24.15 \pm 5.22$  years. As regards qualification of the studied sample it was found that more than two thirds (70.7%) of them were having technical institute of nursing. As regards the nurses' years of experience, it was noticed that the majority (87.8%) were having work experience less 5 years. Regarding marital status, 61% of nurses were married. Regarding taking previous courses about pain and pain relief methods in neonates the vast majority of the studied sample (97.6%) did not take previous courses.

Table 2 demonstrates frequency distribution of pediatric nurses' knowledge regarding pain and selected non-pharmacological methods to relieve pain. It was found that the most pain indicator to be known by nurses in pretest phase is newborns feel pain with a percentage of 63.4% and 85.3% pain resulting from medical and nursing procedures. There was an increase in the nurses' knowledge after conducting the program as about all nurses (100%) identified CRIES scale and Neonatal Infant Pain Scale as neonatal pain assessment tool and the same percent (100%) for nonnutritive sucking, kangaroo care, holding and rocking

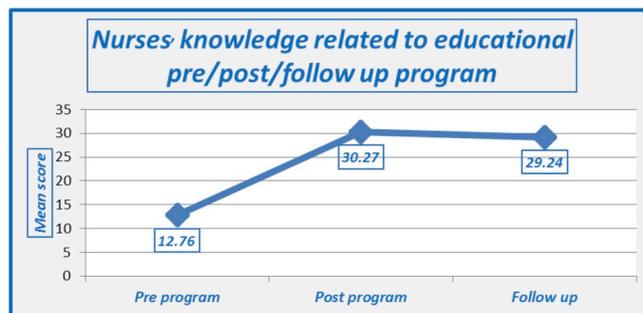
**Table 1**  
Distribution of the Studied Nurses according to their Personal Characteristics (n = 41).

Variables	Frequency (41)	Percentage (%)
<b>Age</b>		
21–30 years	36	87.8
31–40 years	4	9.8
More than 40 years	1	2.4
Range	21–41	
Mean $\pm$ SD	24.15 $\pm$ 5.22	
<b>Qualification of nurses:</b>		
Diploma of Secondary Nursing School	4	9.8
Technical Institute of Nursing	29	70.7
Bachelor in Nursing Science	8	19.5
<b>Years of experience:</b>		
Less than 5 years	36	87.8
6–10 years	1	2.4
More than 10 years	4	9.8
<b>Marital status</b>		
Single	16	39.0
Married	25	61.0
<b>Previous attendance of training courses:</b>		
Yes	1	2.4
No	40	97.6

**Table 2**  
Frequency distribution of pediatric nurses' knowledge regarding pain and selected non-pharmacological techniques to relieve pain (n = 41).

Items	Pre	Post	Follow up	P-value
	F (%)	F (%)	F (%)	
Do you think newborns feel pain	26 (63.4)	41 (100)	40 (97.5)	0.001
Can you determine the cause of pain in newborns	7 (17.1)	37 (90.2)	34 (82.9)	< 0.001
Pain resulting from medical and nursing procedures	35 (85.3)	41 (100)	41 (100)	0.031
Can you determine signs and symptoms of neonatal pain	11 (26.8)	39 (95.1)	38 (92.6)	< 0.001
CRIES Scale	2 (4.8)	41 (100)	34 (82.9)	< 0.001
NIPS Scale	7 (17.1)	41 (100)	41 (100)	< 0.001
Pharmacological Methods	29 (70.7)	41 (100)	41 (100)	< 0.001
Nonnutritive Sucking	7 (17.1)	41 (100)	41 (100)	< 0.001
Kangaroo Care	2 (4.8)	41 (100)	40 (97.5)	< 0.001
Holding and Rocking	11 (26.8)	41 (100)	41 (100)	< 0.001
Swaddling	10 (24.3)	41 (100)	41 (100)	< 0.001

- Mc-Nemar test for comparison of paired qualitative data.
- Probability (p) was considered significant if  $\leq 0.05$ , highly significant if  $< 0.01$ , very highly significant if  $< 0.001$ .
- \*F= Frequency of proper answer.



**Fig. 1.** Total mean scores of pediatric nurses' knowledge regarding pain and selected non-pharmacological methods to relieve pain.

and swaddling as nonpharmacological neonatal pain relief techniques with a very highly significant difference ( $p < 0.001$ ).

Fig. 1 presents total mean scores of pediatric nurses' knowledge regarding pain and selected non-pharmacological methods to relieve

**Table 3**  
The Relation between Total Mean Scores of Pediatric Nurses' Knowledge and their Personal Characteristics regarding Pain and Selected Non-pharmacological Techniques to Relive Pain (n = 41).

	Pre program	Post program	Follow up	P-Value
<b>Age</b>				
21–30 years	13.06 ± 2.714	30.28 ± 1.233	29.22 ± 2.099	< 0.001
31–39 years	10.25 ± 2.217	30 ± 2	29 ± 2.828	
More than 39 years	12	31	31	
P-Value	F = 2.016 P = 0.147	F = 0.241 P = 0.787	F = 0.356 P = 0.703	
<b>Years of experience</b>				
Less than 5 years	13.06 ± 2.714	30.28 ± 1.233	29.22 ± 2.099	< 0.001
6–10 years	9	31	31	
More than 10 years	11 ± 2.160	30 ± 2	29 ± 2.828	
P-Value	F = 2.074 P = 0.140	F = 0.241 P = 0.787	F = 0.356 P = 0.703	
<b>Qualification of nurses</b>				
Diploma of Secondary Nursing School	11 ± 2.160	30 ± 2	29 ± 2.828	< 0.001
Technical Institute of Nursing	12.38 ± 2.718	30.17 ± 1.338	29.14 ± 2.232	
Bachelor in Nursing Science	15 ± 1.852	30.75 ± 0.462	29.75 ± 1.488	
P Value	F = 4.403 P = 0.019	F = 0.720 P = 0.493	F = 0.277 P = 0.759	

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

- ANOVA test to compare quantitative data with sample characteristics.

- Probability (p) was considered significant if ≤ 0.05, highly significant if < 0.01, very highly significant if < 0.001.

pain. An increase in the mean scores in all knowledge areas was observed at the post and follow up program phase compared with pretest phase (12.76 ± 2.7, 30.27 ± 1.2, 29.24 ± 2.13); respectively.

**Table 3:** illustrates that there were a significant differences in pediatric nurses' knowledge after implementing the program regardless of their personal characteristics. Regarding qualification of nurses, there were a significant variations in the mean scores of knowledge between nurses in the pretest phase only; as nurses with bachelor in nursing science has higher mean scores (15 ± 1.852) compared with mean of technical institute nurses (12.38 ± 2.718) and mean of diploma nurses (11 ± 2.160) with a statistical significant difference (P. 0.019).

**Table (4):** presents total mean scores of pediatric nurses' practice regarding pain assessment tools and selected non pharmacological techniques to relive pain. There was an obvious increase in the total mean scores of practice in post and follow up program phase compared with pretest phase (9.07 ± 2.58, 101.07 ± 4.86, 86.41 ± 6.65); respectively with a very highly significant difference (p < 0.001).

**Table (5)** illustrates that there was a significant difference in pediatric nurses' practice after implementing the program regardless of their personal characteristics. Regarding qualification of nurses there were significant variations in the mean scores of practice between nurses in the follow-up phase only; as nurses with bachelor in nursing

**Table 4**  
Total mean scores of pediatric nurses' practice regarding pain assessment tools and selected non-pharmacological techniques to relive pain (n = 41).

	Pre program	Post program	Follow up	P-value
CRIES scale	0 ± 0	14.17 ± 2.03	10.51 ± 2.03	< 0.001
NIPS Scale	0 ± 0	13.65 ± 0.69	11.15 ± 1.75	< 0.001
Hand washing	8.61 ± 2.5	20.98 ± 1.19	19.46 ± 1.93	< 0.001
Nonnutritive Sucking	0.46 ± 0.6	7.46 ± 0.92	5.98 ± 0.90	< 0.001
Kangaroo Care	0 ± 0	14.5 ± 1.2	12.61 ± 1.70	< 0.001
Holding and Rocking	0 ± 0	11.65 ± 0.77	10.63 ± 1.17	< 0.001
Swaddling	0 ± 0	18.66 ± 1.52	16.12 ± 1.60	< 0.001
Total practice	9.07 ± 2.58	101.07 ± 4.86	86.41 ± 6.65	< 0.001
Proper	0 (0%)	41 (100%)	41 (100%)	< 0.001
Improper	41 (100%)	0 (0%)	0 (0%)	

- Dependent Quantitative data by Wilcoxon sign ranked test.

- Probability (p) was considered significant if ≤ 0.05, Highly significant if < 0.01, Very highly significant if < 0.001.

science had higher mean scores (92.25 ± 4.713) compared with the mean of technical institute nurses (85.14 ± 6.457) and the mean of diploma nurses (84 ± 5.944) with a significant difference (P.0.017).

**Figs. 2 and 3** show the correlation between the total scores of pediatric nurses' knowledge and practice in the selected hospitals. It is evident that the highest strong positive statistical significant correlation was found between the total scores of knowledge and practice of nurses who were working at Minia General Hospital MGH (r = 0.665) with a p-value of (p. < 0.001\*\*) and the lowest strong positive statistically significant correlation was found between the total scores of knowledge and practice of nurses who were working at Minia University for Obstetric and Pediatric Hospital MUOPH (r = 0.312) with a p-value of (p. 0.278). In general moderate positive statistical significant correlation was found between the total scores of knowledge and practice of all nurses (r = 0.562) with a very highly significant difference from the pretest (p. < 0.001\*\*).

**Discussion**

Lack of knowledge about pain and its management is a common barrier that contributes to the inadequacy of pain management. Therefore, improving nurses' knowledge through education is important for enhancing pain management. Educational programs should provide nurses with up-to-date information, equip them with better understanding and skills for managing neonatal pain effectively and thereby improve the overall quality of care. Nursing education in pain management, including the use of nonpharmacological methods, has been found to be inadequate, and researchers have identified inadequacy in education on pain management among healthcare professionals as one of the major barriers to effective pain relief (He et al., 2010).

In the present study, all nurses were females and the majority of them were in the age group from 21 to 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 technical institute and this finding is somewhat agreed with that of Huth et al. (2010) whose study revealed that the majority of nurses were having technical education.

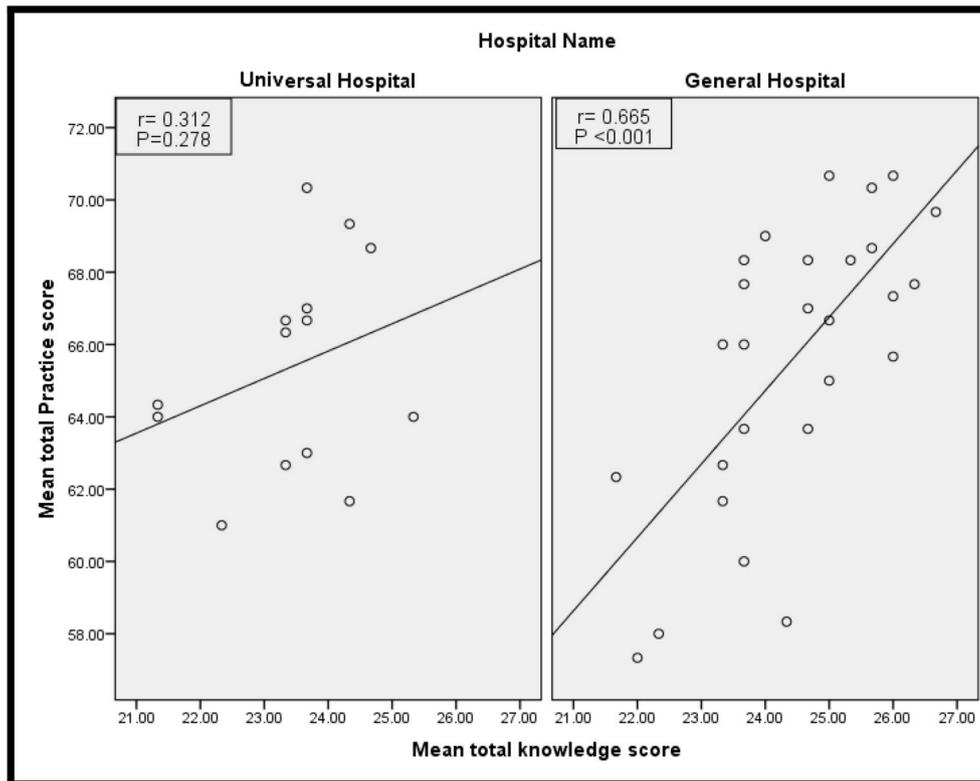
Considering the effect of educational qualification on nurses'

**Table 5**

The Relation between Total Mean Scores of Pediatric Nurses' Practice and their Personal Characteristics regarding Selected Non-pharmacological Techniques to Relieve Pain (n = 41).

	Pre program	Post program	Follow up	P-Value
<b>Age</b>				
21–30 years	9.17 ± 2.689	101.08 ± 4.936	86.89 ± 6.718	< 0.001
31–39 years	8 ± 1.633	100.25 ± 5.252	81 ± 3.916	
More than 39 years	10	104	91	
P-Value	F = 0.421 P = 0.660	F = 0.229 P = 0.796	F = 1.711 P = 0.194	
<b>Years of experience</b>				
Less than 5 years	9.17 ± 2.689	101.08 ± 4.936	86.89 ± 6.718	< 0.001
6–10 years	8	93	79.00 ± 0.0	
More than 10 years	8.5 ± 1.915	103 ± 2.160	84 ± 5.943	
P-Value	F = 0.200 P = 0.819	F = 1.754 P = 0.187	F = 0.974 P = 0.387	
<b>Qualification of nurses</b>				
Diploma of Secondary Nursing School	8.5 ± 1.915	103 ± 2.160	84 ± 5.944	< 0.001
Technical Institute of Nursing	9.07 ± 2.764	100.17 ± 5.504	85.14 ± 6.457	
Bachelor in Nursing Science	9.38 ± 2.387	103.38 ± 0.744	92.25 ± 4.713	
P-Value	F = 0.147 P = 0.864	F = 1.772 P = 0.184	F = 4.561 P = 0.017	

- Mc-Nemar test for comparison of paired qualitative data.
- ANOVA test to compare quantitative data with sample characteristics.
- Probability (p) was considered significant if ≤ 0.05, highly significant if < 0.01, very highly significant if < 0.001.



**Fig. 2.** Correlation between Total Mean Scores of Knowledge and Practice in (pre/post/follow up program) among all Studied Nurses.

knowledge and practice, the findings of this study revealed that there was significant difference in total knowledge only in pretest 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. \(2014\)](#) in which differences in education affect levels of nurses' awareness of infant pain management, and [Wysong \(2014\)](#) who cited that there were no significant differences in mean scores for nurses' practices related to pain assessment based on educational preparation of nurses participated in the study.

According to the present study findings, prior to conducting the educational program, nurses had insufficient knowledge about pain, pain assessment and selected nonpharmacological techniques to relieve pain in neonates. Low scores of nurses' knowledge might be attributed to nurses' neglect reading and updating their knowledge and practices 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 about neonatal pain and its management. These results are in agreement with those of [Noghabi et al. \(2014\)](#) who indicated a low

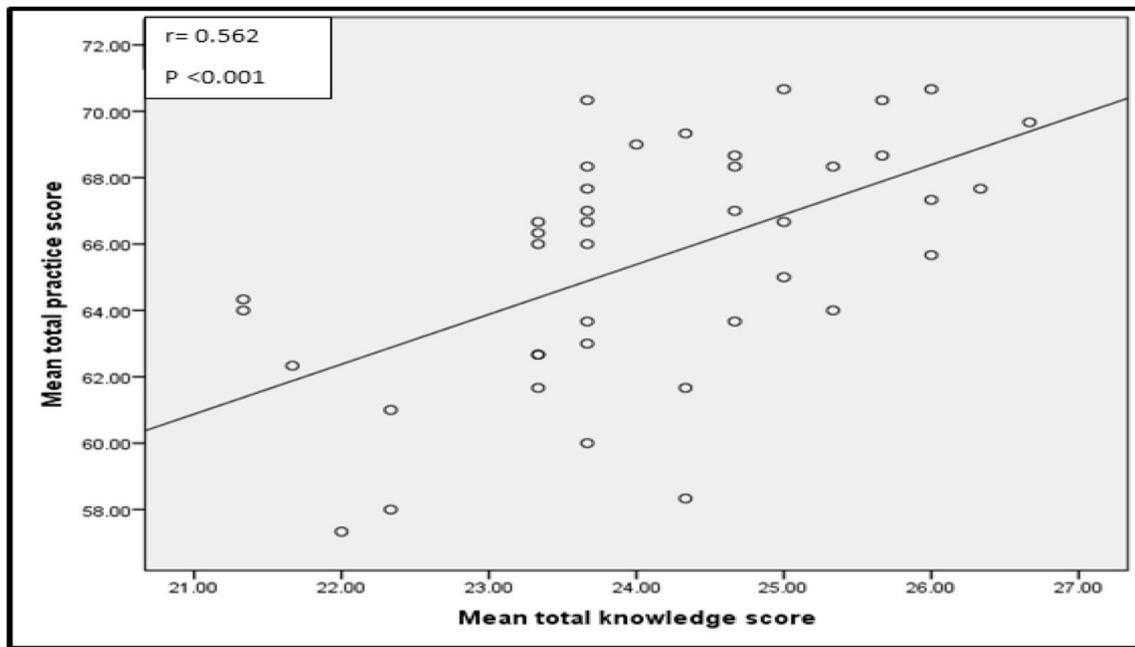


Fig. 3. Correlation between Total Mean Scores of Knowledge and Practice in (pre/post/follow up program) among all Studied Nurses.

level of knowledge about neonatal pain management between nurses.

After program implementation, the post-test had shown highly statistically significant differences in the nurses' total knowledge scores ( $P < 0.001$ ) compared with the pretest phase of all nurses and that reflects the impact of conducting the educational program. These results are consistent with those of [Aymar et al. \(2014\)](#) and [Dongara et al. \(2017\)](#) who reported that there was an improvement in the score of knowledge of the nursing staff following conducting pain management educational program. 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 a statistically significant change when studying the impact of a pain management educational program on pediatric nurses' knowledge about pain management.

Findings of this study revealed that, before conducting the educational program, nurses had improper practice regarding selected non-pharmacological techniques to relieve pain in neonates. These low scores of nurses' practice might be attributed to nurses' lack of knowledge, the absence of sufficient continuing training experiences to upgrade and improve these nurses' practices. These findings are in agreement with findings of studies of [Noghabi et al. \(2014\)](#) and [Dames et al. \(2016\)](#) which illustrated that nurses had a low level of implying an inadequacy in nursing practice in neonatal pain assessment and management.

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 ( $p < 0.001$ ) which indicates the effect of applying the educational program because of nurses' willingness to learn. The findings of the present study are coherent with those of [He et al. \(2010\)](#) and [Aymar et al. \(2014\)](#) in indicating that there was a significant difference in nurses' skills towards patients' experience of pain ( $p < 0.001$ ) following the educational program, including increased usage of the assessment tool and the use of nonpharmacological method of pain relief for all procedures.

Regarding to nurses' performance at the follow up which conducted three months later, the results have revealed statistically significant improvements in all areas of practice with a significant difference from pretest ( $p < 0.001$ ). However, there was a significant decline. Nevertheless, the percentages of proper practice remained higher than those at the pre-program phase, and the differences were still

statistically significant, the attrition of acquired skills over time, might be related to workload which impeded nurses from routinely using the taught practices and also burden of daily living which may be an obstacle in continuous access to previously applied techniques during the program. In this regards, a similar decline also occurred in the study of [Zhang et al. \(2008\)](#) who found that differences were sustained over three months after the Pain Education Program (PEP), while [May et al. \(2009\)](#) reported that nurses' practice regarding nonpharmacological interventions was maintained for 6 months after interventions.

In the post-test and follow up phase there was a moderate correlation between nurse' knowledge and practices with a very highly significant difference from the pretest. This means that nurses put the learned knowledge into practice and the program has achieved the hypothesis on which it was conducted. These results are supported with those of [Aymar et al. \(2014\)](#) who concluded that the professionals involved in the educational intervention perceived changes in pain management at the unit and correlated them to strategies that were defined and implemented in the program.

## Conclusion

**Based on the results of the present study**, it was concluded that nurses in both Minia University for Obstetric and Pediatric and General Hospitals were lacking the necessary basic knowledge and skills related to selected nonpharmacologic techniques to relieve pain 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.

## Recommendations

Based on the findings of the present study the following is recommended:

- More attention must be paid to pain and pain 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 and how to control it.
- Guidelines and rules about pain and pain control should be provided in NICUs.
- A continuous educational and training program with regular dissemination of updated pain management information is an essential component of educational programs that should be planned and offered on regular basis for nurses.
- Replication of the current study on larger probability sample in the same study setting, and adopted in other similar settings with required modifications.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jnn.2019.04.007>.

## References

- AboEl-Maged, A.N., 2011. Effect of Oral Sucrose Administration on Reducing Infantile Sensation of Pain during Obligatory Immunizations at Minia City. A thesis submitted For Partial Fulfillment of the Requirements of Master Degree in Pediatric Nursing. Assuit University, pp. P43.
- Anand, K.J.S., Eriksson, M., Boyle, E.M., Avila-Alvarez, A., Andersen, R.D., Sarafidis, K., Polkki, T., Matos, C., Lago, P., Papadouris, T., Attard-Montalto, S., Ilmoja, M.L., Simons, S., Tameliene, R., van Overmeire, B., Berger, A., Dobrzanska, A., Schroth, M., Bergqvist, L., Courtois, E., Rousseau, J., Carbajal, R., EUROPAIN survey working group of the NeoOpioid Consortium, 2017. Assessment of continuous pain in newborns admitted to NICUs in 18 European countries. *Acta Paediatr.* 106 (8), 1248–1259. Retrieved from: <http://onlinelibrary.wiley.com/doi/10.1111/apa.13810/abstract>.
- Aymar, C., Lima, L., Santos, C., Moreno, E., Coutinho, S., 2014. Pain assessment and management in the NICU: analysis of an educational intervention for health professionals. *Journal de pediatria* 90 (3), 308–315. Retrieved from: <https://ac.els-cdn.com/S0021755714000266/1-s2.0-S0021755714000266-main.pdf?>
- Basavanhappa, B., 2015. *Child Health Nursing*, first ed. Jaypee Brother Medical Publishers, India, pp. P288.
- Bowden, V., Greenberg, C.S., 2012. *Pediatric Nursing Procedures*, third ed. Wolters Kluwer, Lippincott Williams & Wilkins, China, pp. 383–782.
- Boxwell, G., 2010. *Neonatal Intensive Care Nursing*, second ed. United States of America, Routledge. P234.
- Cong, X., Delaney, C., Vazquez, V., 2013. Neonatal nurses' perceptions of pain assessment and management in NICUs: a national survey. *Adv. Neonatal Care* 13 (5), 353–360.
- Cong, X., McGrath, J., Delaney, C., Chen, H., Liang, Sh, Vazquez, V., Keating, L., Chang, K., Dejong, A., 2014. Neonatal nurses' perceptions of pain management: survey of the United States and China. *Pain Manag. Nurs.* 15 (4), 1–11.
- Dames, L.J., Alves, V.H., Rodrigues, D.P., Souza, R.R., Medeiros, F.V., Paiva, E.D., 2016. Nurses' practical knowledge on the clinical management of neonatal pain: a descriptive study. *Online Braz. J. Nurs.* 15 (3), 393–403. Retrieved from: [http://www.objnursing.uff.br/index.php/nursing/article/view/5413/pdf\\_1](http://www.objnursing.uff.br/index.php/nursing/article/view/5413/pdf_1).
- Dongara, A., Nimbalkar, S., Phatak, A., Patel, D., Nimbalkar, A., 2017. An educational intervention to improve nurses' understanding of pain in children in western India. *Pain Manag. Nurs.* 18 (1), 24–32.
- Dowd, J., 2009. Impact of a Pain Management Educational Program on Pediatric Nurses' Knowledge and Attitudes about Pain Management. A project submitted in partial fulfillment of the requirements for the degree of Master of Science in Nursing at Northern Kentucky University Northern Kentucky University, P24 Retrieved from: <https://search.proquest.com/openview/787546b0bc52159616acebb479b71db8/1?pq-origsite=gscholar&cbl=18750&diss=y>.
- Fernandes, A., Yeo, N.C., Johnston, C.C., 2011. Procedural pain management for neonates using nonpharmacological strategies. *Adv. Neonatal Care: Off. J. Nat. Assoc. Neonatal Nurses* 11 (4), 235–241. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/22123343>.
- Gardner, S., Carter, B., Enzman-Hines, M., Hernandez, J., 2012. *Merenstein & Gardner's Handbook of Neonatal Intensive Care*, seventh ed. United States of America. Library of Congress Cataloging in Publication Data, pp. P223.
- He, H.G., Jahja, R., Lee, T., Ang, E.N., Sinnappan, R., Julkunen, K.V., Chan, M.F., 2010. Nurses' use of non-pharmacological methods in children's postoperative pain management: educational intervention study. *J. Adv. Nurs.* 66 (11), 2398–2409. Retrieved from: <http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2648.2010.05402.x/epdf>.
- Healthy children org, 2013. Swaddling: is it safe? American academy of pediatrics. Retrieved from: <https://www.healthychildren.org/English/ages-stages/baby/diapersclothing/Pages/Swaddling-Is-it-Safe.aspx> Accessed on January, 20, 2017. 7:30PM.
- Ho, L.P., Ho, S.S., Leung, D., Chan, C., 2016. A feasibility and efficacy randomized controlled trial of swaddling for controlling procedural pain in preterm infants. *J. Clin. Nurs.* 25 (3–4), 472–482. Retrieved from: <http://onlinelibrary.wiley.com/doi/10.1111/jocn.13075/epdf>.
- Hockenberry, M., Wilson, D., 2015. *Wong's Nursing Care of Infants and Children*, tenth ed. Marilyn J. Hockenberry, David Wilson, Canada, pp. 158–167.
- Huth, M.M., Gregg, T., Lin, L., 2010. Education changes Mexican nurses' knowledge and attitudes regarding pediatric pain. *Pain Manag. Nurs.* 11 (4), 201–208.
- Jeong, I.S., Park, S.M., Lee, J.M., Choi, Y.J., Lee, J., 2014. The frequency of painful procedures in neonatal intensive care units in South Korea. *Int. J. Nurs. Pract.* 20 (4), 398–407. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/24118662>.
- Kostak, M.A., Inal, S., Efe, E., Yilmaz, H.B., Senel, Z., 2015. Determination of methods used by the neonatal care unit nurses for management of procedural pain in Turkey. *JPMA (J. Pak. Med. Assoc.)* 65 (5), 526–531. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/26028388>.
- Kyle, T., Carman, S., 2013. *Essential of Pediatric Nursing*, second ed. Wolters Kluwer Health/Lippincott Williams & Wilkins, China, pp. P426.
- Mahfoz, F.F., 2008. Impact of an Educational Program on Non-Pharmacological Pain Management for Nurses in Medical Pediatric Units Among Hospitalized School Age Children in General Hospitals in Port Said. A thesis submitted For Partial Fulfillment of the Requirements of Doctorate Degree in Pediatric Nursing. Suez Canal University, pp. 50–51.
- May, S.L., Johnston, C., Choiniere, M., Fortin, Ch, Kudirka, D., Murray, L., Dominic Chalut, D., 2009. Pain management practices in a pediatric emergency room (PAMPER) study interventions with nurses. *Pediatr. Emerg. Care* 25 (8), 498–503.
- Min, H., Vincent, C., Matthews, A., McCreary, L., Park, Ch, Latimer, M., 2017. Factors affecting Korean neonatal infant pain care: translation and validation of three instruments. *West. J. Nurs. Res.* 40 (2), 222–241. Retrieved from: <http://journals.sagepub.com/doi/abs/10.1177/0193945917690124>.
- Motta, G.C., Cunha, M.L., 2015. Prevention and non-pharmacological management of pain in newborns. *Rev. Bras. Enferm.* 68 (1), 123–127. Retrieved from: [http://www.scielo.br/pdf/reben/v68n1/en\\_0034-7167-reben-68-01-0131.pdf](http://www.scielo.br/pdf/reben/v68n1/en_0034-7167-reben-68-01-0131.pdf).
- Nimbalkar, A., Dongara, A., Phatak, Nimbalkar, S., 2014. Knowledge and attitudes regarding neonatal pain among nursing staff of pediatric department: an Indian experience. *Pain Manag. Nurs.* 15 (1), 69–75.
- Noghabi, F.A., Farahi, M.T., Yousefi, H., Sadeghi, T., 2014. Neonate pain management: what do nurses really know? *Glob. J. Health Sci.* 6 (5), 284–293. Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4825505/pdf/GJHS-6-284.pdf>.
- Ottawa Neonatal Pain Interest Group, 2015. Newborn pain management: a practice approach self-learning module. Retrieved from: [http://www.cmnrp.ca/uploads/documents/Newborn\\_Pain\\_SLM\\_2015\\_02\\_19\\_FINAL.pdf](http://www.cmnrp.ca/uploads/documents/Newborn_Pain_SLM_2015_02_19_FINAL.pdf) Accessed on August, 25, 2017. 4PM.
- Rajesh, S., Swamy, A.A., 2014. Effectiveness of video assisted teaching programme on knowledge regarding non pharmacological pain relieving intervention for children among staff nurses in selected hospital. *Asian Journal of Multidisciplinary Studies* 2 (10), 122–133. Retrieved from: <http://www.ajms.co.in/sites/ajms2015/index.php/ajms/article/view/654/543>.
- Romanek, F.A., Avelar, M.D., 2014. Teaching of Nursing interventions as non-pharmacological strategy for pain relief. *Revista Dor* 15 (4), 264–266. Retrieved from: [http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S1806-00132014000400264](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1806-00132014000400264).
- Sawires, H., Abd-El Meguid, M., Ishak, M., Abd-El Hady, M., 2014. Do term newborns respond similarly to different painful procedures? *Iran. J. Pediatr.* 24 (6), 679–684. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4442827/pdf/IJP-24-679.pdf>.
- Srouji, R., Ratnapalan, S., Schneeweiss, S., 2010. Pain in children: assessment and non-pharmacological management. *Int. J. Pediatr.* 2010 (2010), 1–11. Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2913812/>.
- Stanley, M., Pollard, D., 2013. Relationship between knowledge, attitudes, and self-efficacy of nurses in the management of pediatric pain. *Contin. Nurs. Educ.* 39 (4), 165–171. Retrieved from: <http://pediatricnursing.net/ce/2015/article3904165171.pdf>.
- Syan, Sh, 2014. Efficacy of Distraction on Pain Relieve during Lumber Puncture in Children with Leukemia at South Egypt Cancer Institute-Assuit University. A thesis submitted For Partial Fulfillment of the Requirements of Master Degree in Pediatric Nursing. Assuit University P2.
- Wallace, H., Jones, T., 2017. Managing procedural pain on the neonatal unit: do inconsistencies still exist in practice? *J. Neonatal Nurs.* 23 (3), 119–126. Retrieved from: <http://www.sciencedirect.com/science/article/pii/S1355184116301508>.
- Wilson-Smith, E., 2011. Procedural pain management in neonates, infants and children. *Rev. Pain* 5 (3), 4–12. Retrieved from: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4590075/pdf/10.1177\\_204946371100500303.pdf](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4590075/pdf/10.1177_204946371100500303.pdf).
- Wysong, P.R., 2014. Nurses' beliefs and self-reported practices related to pain assessment in nonverbal patients. *Pain Manag. Nurs.* 15 (1), 176–185.
- Zhang, Ch, Hsu, L., Zou, B., Li, J., Wang, Huang, J., 2008. Effects of a pain education program on nurses' pain knowledge, attitudes and pain assessment practices in China. *J. Pain Symptom Manag.* 36 (6), 616–627. Retrieved from: [http://www.jpmsjournal.com/article/S0885-3924\(08\)00253-4/pdf](http://www.jpmsjournal.com/article/S0885-3924(08)00253-4/pdf).