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Effect of Mothers' Voice Recorded, Breast Milk Odor on Preterm Infants' Pain and Comfort Response during Peripheral Cannulation

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Abstract:
Evidence illustrated that alleviating pain in the preterm infants improve physiological, behavioral, and provide comfort. Mothers' voice recorded or breast milk odor may play a critical role as a non-pharmacological pain treatment during peripheral cannulation. Thus, the present study was aimed to investigate mothers' voice recorded, odour of breast milk on preterm babys' pain and comfort response during peripheral cannulation. A quasi-experimental design was utilized on the current study. A convenient **Sample** of all available preterm infants (150 preterm infants) attending the Neonatal Intensive Care Unit (NICU) at Minia University Hospital for Obstetric and Pediatrics (MUHOP) and Misr El-Hora general hospital which affiliated to ministry of health and population, (50 mothers' voice recorded, 50 breast milk odor, and 50 control groups). A structured interview questionnaire sheet included preterm infant data, Preterm Infant Pain Profile (PIPP) and Premature Infant Comfort Scale (PICS) were utilized for data collection. **Results** of the presents study shows significant mean difference between mothers' voice recorded, breast milk odor, and control groups regarding PIPP pain and PICS comfort assessment scores in four times (before as well as during, immediately after, and 5 minutes after peripheral cannulation) at P< 0.0001. The study **Concluded** that, mothers' voice recorded and breast milk odor groups showed a significant reduction in the total mean score of preterm infant's discomfort and pain than control group during peripheral cannulation. **The Study Recommended** that, new researches required to evaluate the impact of mothers' voice recorded and odour of breast milk on preterm infant pain and comfort response on large sample size.

Keywords: ***Breast Milk Odor, Comfort Response, Mothers' Voice Recorded, Pain, Peripheral Cannulation & Preterm Infants.***

Introduction:
In Neonatal Intensive Care Unit, Preterm infants are periodically exposed to painful procedures as (blood samples are drawn for them to conduct medical analyzes and insertion of peripheral cannulation) This pain may lead to delay in brain development, and also may lead to muscle spasms, changes in urine and digestive process for them. In the late 1980s, it was thought that newborns were unable to perceive pain due to underdeveloped pain receptors and incomplete sensory neurons. Subsequently, recent research has shown that newborns are not only able to perceive and experience pain, but are also more sensitive and more susceptible to pain than adults **(Perry, et al., 2018 & Goksan, et al., 2015).**

Preterm infants are exposed to many unfamiliar stimuli that are completely different from their sensory experience inside the intrauterine life. Despite the low death rate, it's noticed many problems in neurodevelopment, educational and behavioral disorders, and disorders in different types of their development. Therefore, we need a lot of approaches that are used before, during and after any procedure for these newborn to reduce the effect of these stressful stimuli and increase the stimuli that support development based on observations regarding the infant's physiological and behavioral responses to different stimuli **(Özdemir & Tüfekci, 2014; Rodrigues, & Guinsburg, 2013).**

Pain can be effectively controlled and reduced when exposed to painful stimuli through the utilize of both drug and non-drug techniques, but due to the proplems of pharmacological techniques for pain relief, the use of pharmacological treatment is less, unlike non-pharmacological techniques that the neonate's or caregivers carry out, which is a series of activities innovative, effective, simple, safe and inexpensive, which reduce the neonate's pain or make it bearable in addition to being free from medical complications **(Azarmnejad, et al., 2015)**

Hearing is one of the first senses that develops in the fetus, as auditory responses develop in the auditory cortex and brainstem at the 26^{th} – 28^{th} week of the fetus's age, when it becomes able to recognize and remember the mother's voice from the 24^{th} to the 33^{rd} week, so the fetus memorizes the musical

characteristics of the mother's sound by listening to it like a tune. The fetus, while inside the womb, can receive auditory stimulation and preserve it, and this has a lasting effect on its brain development and adaptation in the future **(Choi et al., 2014).**

Hearing its mother's voice helps the fetus feel secure, which is important for its development since it allows the sensory system to progress more slowly and steadily. The mother's voice has been shown to be an essential sensory input for the fetus in the intrauterine environment and to play an essential role in the critical phase for the fetus's morphological and functional development **(Moon, 2017).**

Many researches have been conducted on stimulating the olfactory system in pre-term infants, as it was found that the odor of mother's milk is one of the odors that stimulates positive responses to the pre-term infants, and the results of these researches include reducing pain, improving breathing, early initiation of oral feeding, and faster weight gain **(Khakpour, et al., 2022), (Ahmed, 2019) & (Baudesson, et al., 2017).**

By the 11th week of pregnancy, human embryos have fully differentiated olfactory cells, demonstrating the structural and functional development of the chemosensory system in the first trimester. As a result, preemies could respond positively to maternal scents as a manner of comforting them through distressing treatments. During stressful and unpleasant situations, olfactory stimulation aided in regaining calm and thus reduced energy expenditure. The association between intrauterine maternal odor and feeding suggests that neonates are especially attuned to maternal scents (breast milk, amniotic fluid) **(Maayan-Metzger, 2018).**

Significance of the study

Preterm infants experienced a high degree of pain & stressors during any procedure in the NICU, which negatively affects their development and delay their stay in hospital, so different approaches which decrease pain and induced comfort must be used **(Cong, et al., 2017).** One of these approaches is non-pharmaceutical maternal interference is significant for hospitalized preterm infants as an alternative method to provide stable and fair stimulation and facilitate preterm infant-suitable care **(Yu, et al., 2022).**

When applied to premature infants, pain has short-term effects that can alter the stability of physiological parameters like heart rate, oxygen saturation, and respiration; somatosensory thresholds; and neurodevelopment; all of which have consequences for brain structure, behavior, and cognitive ability. Nurses and clinicians in the NICU should be motivated to think about non-pharmacological approaches to pain management because of the harmful effects that pain has on preterm newborns during routine operations **(Tortora, et al., 2019).**

Result of some researches showed that mothers' sound and breast milk odor could lower pain and discomfort scores across a procedure, compared with group not receiving sensory stimuli and demonstrated the odor of breast milk from an infant's mother had analgesic effects during painful procedures **(Lan, et al., 2021).**

Aim of the study

The present study aimed to determine the effect of mothers' voice recorded, breast milk odor on preterm infants' pain and comfort response during peripheral cannulation

Research hypotheses

H0: The interventions of mothers' voice recorded, breast milk odor expects to make not change on preterm infants' pain and comfort response before, during, immediately after, and 5m after peripheral cannulation.

H1: The interventions of mothers' voice recorded, breast milk odor expects to reduce pain severity for preterm infants' before, during, immediately after, and 5m after peripheral cannulation.

H2: The interventions of mothers' voice recorded, breast milk odor provide comfort for preterm infants (before, during, immediately after, and 5m after) peripheral cannulation.

Subjects and Method

Research design: quasi experimental research design was utilized in the current study.

Setting: The study was conducted in the Neonatal Intensive Care Unit (NICU), at Minia University Hospital for Obstetrics and Pediatrics (MUHOP) and Misr El-Hora general hospital which affiliated to ministry of health and population. NICU in both hospitals receives neonates from all over Minia governorate who complained of different diseases, and the total numbers of incubators in both units are 50 incubators and provide levels of care up to the 3rd level.

Sample: A purposive sample of 150 preterm infants who admitted to neonatal intensive care unit at Minia University Hospital for Obstetric and Pediatrics (MUHOP) and Misr El-Hora general hospital who met the **inclusion criteria** (Heart rate, blood pressure (BP), age-appropriate respiratory rat(RR)e, and oxygen saturation (O2)were all stable within the first twenty- four hours of life. Additionally, there were no congenital defects that might have affected breathing or caused asphyxia, the baby had spontaneous respiration at birth, and there was no cranial bleeding or hyperbilirubinemia that might have caused blood abrasions. Preterm infant born after the thirty weeks

of gestation but before the thirty-four weeks of gestation, birth weight more than one Kg, more than 6 of Apgar). The sample was divided into three equal groups (50 preterm infants) mothers' voice recorded group, (50 preterm infants) breast milk odor group and (50 preterm infants) control group. A power analysis was performed using 0.05 as the level of significance, 0.95 as the power, and a 0.25 effect size to estimate the sample size. 150 preterm infants—the bare minimum needed sample size were collected.

Exclusion criteria: meningitis; newborn seizures; intracranial hemorrhage; periventricular leukomalacia; chromosomal abnormalities; craniofacial abnormality; need for mechanical ventilation; bronchopulmonary dysplasia or other persistent lung illness.

Tools for data collection

The next 3 instruments were utilized to gather the data:-

Tool one: Structured Interview Questionnaire Sheet: It was developed by the researcher after reviewing the related literature and consisted of demographic characteristics of the preterm infants include the neonate's age per day, gender of neonate, gestational age, birth weight of neonate, Apgar score, as well as diagnosis **(Casavant, et. al., 2017).**

Tool two: (PIPP) Premature Infant Pain Profile; this tool adopted from **(Stevens, et al., 2015).** It's the best standard for measuring discomfort in newborns, both full-term and premature.

Scoring system: The responses of the **(PIPP)** rating are on a score from zero to twenty-one. Score from zero to six reflects no or minimal pain, as well as from seven to twelve reflects slight to moderate pain, while more than twelve reflects severe pain. It consists of seven items as following; gestational age, the behavioral state, the heart rate(pulse), oxygen saturation (o_2), brow bulge, the eye squeeze, and naso- labial furrow.

Tool three: Preterm Infant Comfort Scale (PICS) adopted from **(Alemdar & Tüfekçi, 2015).** It is a numerical assessment scale help the researcher to assess discomfort of the neonates, in addition to comfort level. The scale is composed of 7 behavioural dimensions such as, respiratory response, alertness, calmness, facial expression, and muscle strength and body movement. The respiratory response is excluded by the researcher as it applied to ventilated neonates only; requiring continuous positive airway and actually the researcher used 6 dimensions.

Scoring system

The responses of the (PICS) ranged from 1 to 5 Likert score, the score ranged from 6 which is the lowest score and the highest score in the scale is 30, the higher scores indicated that the infant is less comfortable and needs comforting measures. A score between 6 and 13 reveals that the neonate is comfortable and a score between 14 and 30 indicates that the neonate is uncomfortable and has pain/stress and needs comforting interventions **(Taşdemir & Efe, 2019).**

Pilot Study: Pilot study was conducted on 10% of preterm infants (15 preterm infants) who met the inclusion requirements, this was done to check for flaws with the methodology and make sure everything was clear, concise, appropriate, and logical. The recommended statistical and data analysis methods were tested with the pilot study's results. All newborns who took part in the preliminary trial were included in the final sample size.

Validity and reliability: Three experts from Minia University, pediatric nursing department evaluate the tool. Content coverage, clarity, relevance, application, language, length, structure, and overall look were evaluated. The reliability of both tools (PIPP&PICS) was assessed and Cronbach's alpha values to be (0.84 for PIPP&0.805 for PICS) were obtained.

Data collection procedure

Mothers' voice recorded group, in breast feeding room in neonatal intensive care unit at previous mention setting, the researchers explained (aim, steps, technique and advantages of this technique for preterm infants), after that encouraging mothers to discuss her ideas & emotions and to say what she needed to tell her preterm infant by it. As she spoke, her voice was recorded by using (a sound recorder on mobile) considering sterilization the mobile before using (alcohol 70%). Then, preterm infant was listening to this recording at 45 dB for 15 minutes inside the incubator before the procedure. The recording was then played throughout and for fifteen minutes after the procedure.

Breast milk odor group, in breast feeding room in neonatal intensive care unit at previous mention setting, the researcher explained (aim, steps, technique and advantages of this technique for preterm infants). Every preterm infant in this study group had breast milk collected from their mothers using (a manual breast pump which was bought by the researchers and explained to mothers how to use and sterilize it). It was hypothesized that the newborn could smell the breast milk when 3:5 cm of milk was poured into a sterile sponge 15 minutes before the procedure and placed 5 cm away from the nose. The baby persisted to smell the milk during and fifteen minutes after cannulation.

Control group, preterm infants at neonatal intensive care unit in previous mention setting who fulfill inclusion criteria, peripheral cannulation was conducted according standard clinical practice.

The same nurse who have more experience at NICU worked the day shift and conducted all peripheral canulations. Researchers at NICU did not give newborns undergoing peripheral cannulation any pain medication or any pain relief. There were no differences between the intervention and control groups on any of the variables that could have affected the preterm infants' experience of pain.

All preterm children had their basilic and cephalic veins used during the surgery. After selecting a suitable vein, the area was cleansed from the centre outward using 70% alcohol as a skin antiseptic. When the preterm baby was not wailing, the procedure was performed; if the baby was sobbing, the nurse waited two minutes before doing so. After waiting for at least thirty seconds, the treatment was carried out. The treatment utilized yellow catheter number twenty-four. The nurse placed a cannula needle at an angle of 15°-20° into the tissue. So, needles were used to simultaneously pierce the skin and access to vein. Catheters were secured on the skin utilized plaster's transparent after needle placement was confirmed.

The researcher used a video camera to film preterm infants before, during, and after the treatment. For all groups, video filming began 1 minute prior to the procedure and continued for 15 minutes after the procedure. Pain and comfort level were evaluated by evaluator (the researcher and 2 expert nurses) by utilizing of PIPP pain assessment scale and PICS comfort assessment scale English version. Then, write the average of the 3 readings and calculated the average of comfort and pain score in relation to scoring system by the researchers. Pain and comfort level measured four times (before procedure, during, immediately after and 5m after procedure). The mothers' voice recorded, the breast milk odor, and control groups were assessed with the same scale at the same time and with the same manner.

Field of the work

The time frame for this data collection is April 1, 2022, through July 31, 2022. Between 25 and 30 minutes were spent on each neonate to get the necessary information. The researchers kept track of each neonate for the specified period of time. Neonatal records were used to gather demographic and biological information about preterm newborns.

Statistical Analysis

Data entry was done through using a compatible personal computer. After data collection, it was revised, coded, and a statistical package for the social science version (IBM 25) was used to analyze the data, as it contains the test of significance given in standard statistical books, employing the proper statistical analysis. Chi-square test, Kendall's W test, percentages, distribution, mean, and standard deviation, as well as one-way ANOVA (between groups), (P-value) is the degree of significance; less than 0.05 was considered significant.

Ethical considerations: The Minia University Nursing Faculty's Research Ethics Committee provided written clearance for this study. And also, the researcher obtained a written consent from the director of the previous mentioned hospitals as well as from the director of the neonatal intensive care units. A Written formal consent was obtained from the neonates' mothers who participated in this study. The researcher explained the study's purpose and nature through direct personal interviews ensuring that the data were confidential and is used for the research purpose only. The study adhered to common ethical principles to participate in the research, anonymity, and privacy was present through coding the data, and the mother has the right to reject participation in the study without any justification.

Results

Table (1): Comparison between the Studied Sample Regarding their Demographic Characteristics Data (n=150).

The demographic characteristics data	Mothers' voice recorded group (n=50)		Breast milk odor group (n=50)		Control group (n=50)		Test of significance	
	No	%	No	%	No	%	F	P-Value
Age of preterm infants/days								
3	8	16	10	20	14	28	3.537	0.171
4	14	28	9	18	13	26		
5	13	26	9	18	10	20		
6	4	8	15	30	9	18		
7	11	22	7	14	4	8		
Mean ± SD	4.920±1.382		5±1.370		4.520±1.297			
Gestational age/ weeks							**F**	**P value**
30	13		26		8		2.531	0.282
32	19		38		26			
33	10		20		14			
34	8		16		2			
Mean ± SD	32±1.385		32±1.049		32.280±1.161			
Gender							**x2**	**P value**
Male	28	56	28	56	27	54	0.054	0.974
Female	22	44	22	44	23	46		
Apgar score at the 1st minute							**x2**	**P value**
7 score	20	40	19	38	18	36	0.410	0.815
8 score	22	44	25	50	23	46		
9 score	8	16	6	12	9	18		

F (ANOVA test) *X2 (chi-square test)*

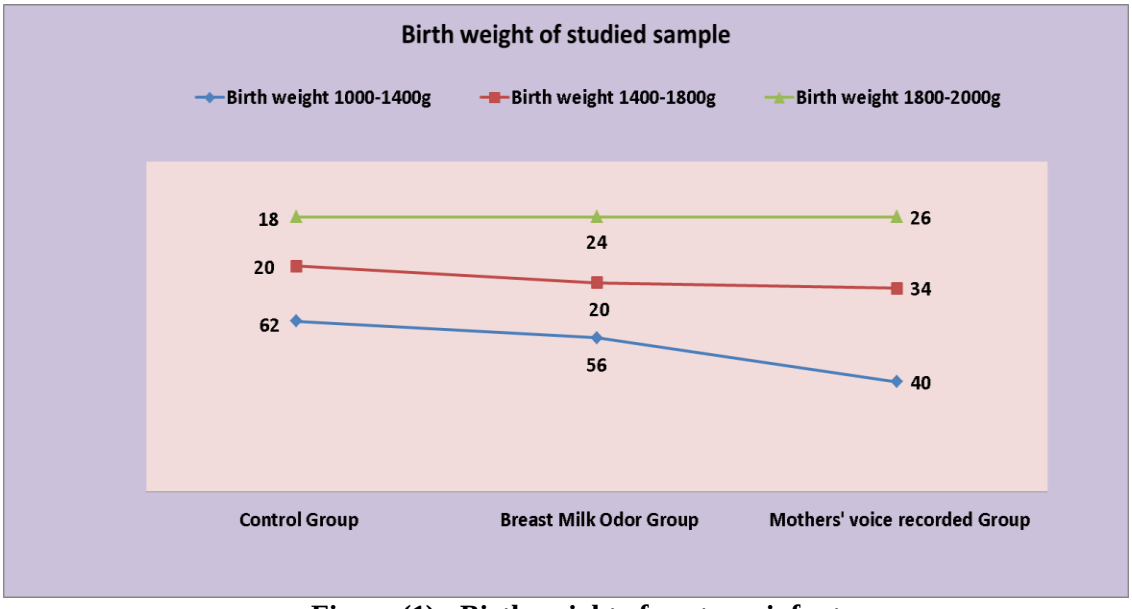

Figure (1): Birth weight of preterm infants

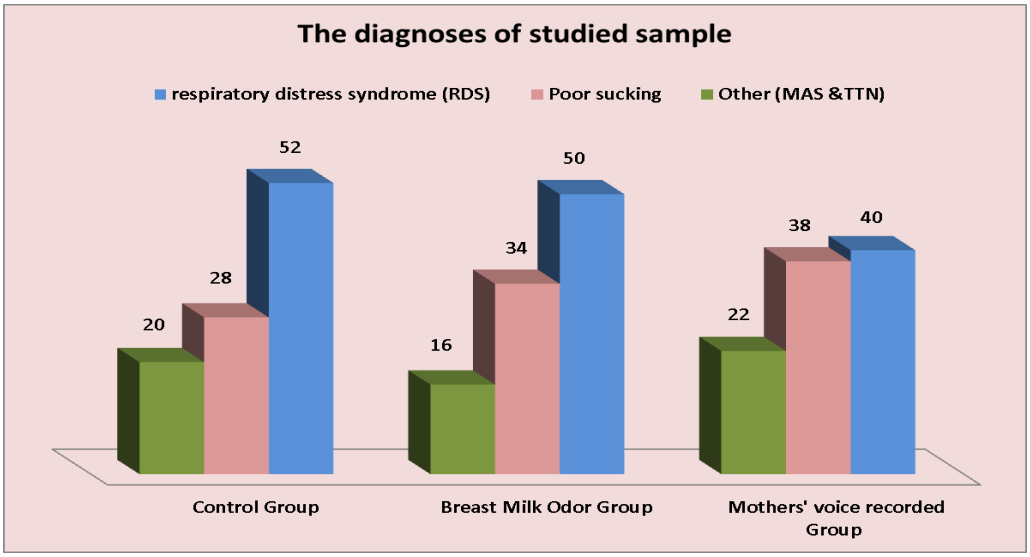

Figure (2): Diagnosis of preterm infants.

Table (2): Comparison between the studied sample total mean score of PIPP scale before, during, immediately after, and 5 minutes after cannulation (n=150).

Total Mean Score of PIPP Scale	Mothers' voice recorded Group (n=50)	Breast Milk Odor Group (n=50)	Control Group (n=50)
	Mean ± SD	Mean ±SD	Mean ± SD
Before procedure	3.50±0.789	4.54±1.146	4.58±1.126
F (P-value)	**2.382(0.123)**		
During procedure	13.4±1.905	15.8±1.399	15.8±1.399
F (P-value)	**57.364 (0.0001) ****		
Immediately after procedure	7.52±1.632	8.32±1.219	9.68±1.202
F (P-value)	**43.477 (0.0001) ****		
5m after cannulation	5.18±0.690	5.52±0.762	6.46±0.885
F (P-value)	**47.837 (0.0001) ****		

***= Highly statistically significant differences ANOVA test was used*

Table (3): Mean differences related to items of PIPP scales between the studied sample n= (150)

	Before		During		Immediately after		After 5 M	
	F	P-Value	F	P-Value	F	P-Value	F	P-Value
Behavioral state	2.478	0.290	0.167	0.920	3.165	0.205	0.762	0.683
Heart rate	116.282	0.0001**	132.795	0.0001**	131.970	0.0001**	133.416	0.0001**
Oxygen saturation	8.162	0.138	113.198	0.0001**	43.209	0.0001**	50.928	0.0001**
Brow bulge	13.806	0.005*	10.950	0.004*	7.148	0.028*	13.284	0.001
Eye squeeze	7.106	0.029*	9.215	0.05*	9.161	0.01*	7.775	0.02*
Nasolabial furrow	1.144	0.564	0.447	0.800	1.371	0.504	0.540	0.763

**= statistically significant differences **= Highly statistically significant differences*

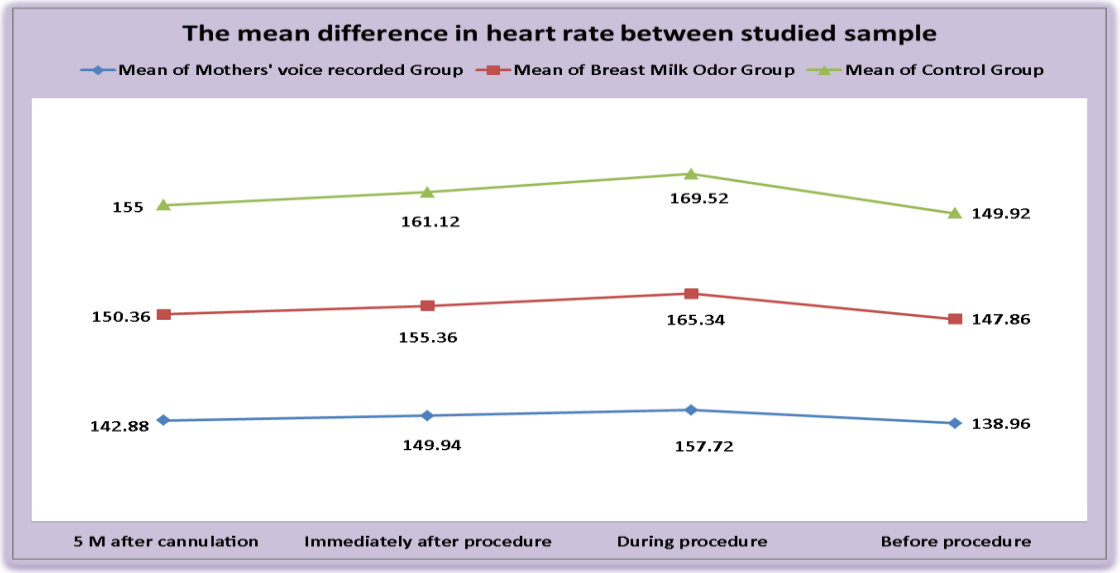

Figure (3): Mean difference in heart rate between the studied sample (before, during, immediately after, and 5m after cannulation) (n= 150)

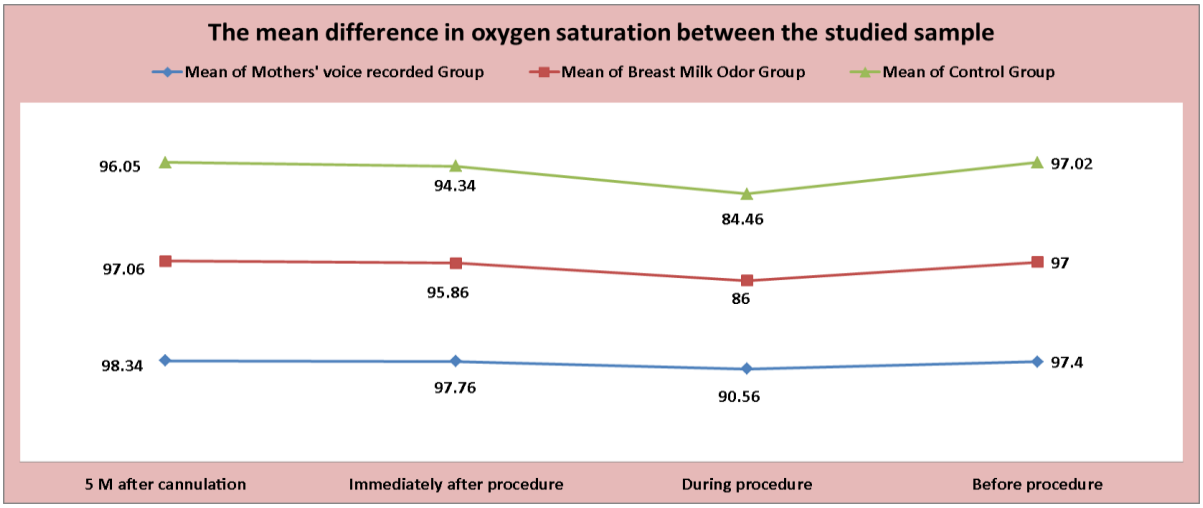

Figure (4): Mean difference in oxygen saturation between the studied sample (before, during, immediately after, and 5m after cannulation) (n=150)

Table (4): Comparison between the studied sample regarding total mean score of PICS before, during, immediately after, and 5 m after cannulation (n=150)

Total Mean Score of PICS	Mothers' voice recorded Group	Breast Milk Odor Group	Control Group
	Mean ± SD	Mean ±SD	Mean ± SD
Before procedure	11.96±2.089	13.12±1.520	13.7620±1.015
F (P-value)	5.453 (0.069)		
During procedure	17.01±1.470	18.72±1.294	19.30±0.974
F (P-value)	24.242 (0.0001) **		
Immediately after procedure	16.46±1.417	18.22±1.0745	18.38±1.338
F (P-value)	74.702 (0.0001) **		
5 minutes after cannulation	9.20±1.428	9.38±1.383	11.82±1.335
F (P-value)	63.012 (0.0001) **		

***= Highly statistically significant differences*

Table(5): Mean differences related to items of PICS between the studied sample (n= 150).

	Before		During		Immediately after		After 5 M	
	F	P-Value	F	P-Value	F	P-Value	F	P-Value
Alertness	0.36	0.982	1.324	0.516	2.12	0.346	3.301	0.192
Calmness	6.478	0.039*	2.545	0.28	9.547	0.008**	14.5	0.001**
Crying	5.992	0.05*	4.984	0.083	6.727	0.035*	12.453	0.006**
Body movement	1.905	0.386	1.043	0.594	2.638	0.267	4.569	0.102
Facial tension	1.581	0.454	0.375	0.829	1.884	0.390	2.065	0.356
Body muscle tone	0.431	0.806	2.205	0.332	2.12	0.346	1.966	0.374

*= *Statistically significant differences* **= *Highly statistically significant differences*

Table (1): Cleared that there was no statistically significant difference between the studied samples regarding to preterm infants' characteristics. Mean ± SD of preterm infants age after birth by days in mothers' recorded voice, breast milk odor and control groups (4.920±1.382, 5±1.370, and 4.520±1.297 days); respectively, More than half precent of three groups were male in mothers' recorded voice, breast milk odor and control groups (56%, 56%, and 54%); respectively.

Figure (1): Showed preterm infants birth weight 1000-1400g in mothers' recorded voice, breast milk odor and control groups was (40%, 56%, and 62%); respectively. Mean ± SD of preterm infants birth weight in mothers' recorded voice, breast milk odor and control groups was (1476.60±307.121, 1399.60±310.384, and 1362.4±290.590 grams); respectively.

Figure (2): Showed that about half of the preterm infants diagnosis in the three groups were respiratory distress syndrome(RDS) on admission in mothers' recorded voice, breast milk odor and control groups (40%, 50%, and 52%); respectively.

Table (2): Illustrated that there was a highly statistically significant differences between the studied sample regarding total PIPP pain assessment scores in three times (during, immediately after, and 5m after cannulation) at P< 0.0001. Mothers' voice recorded group had the lowest mean of PIPP score compared to other two groups. All participants before the procedure had no pain according to PIPP in the mothers' recorded voice, breast milk odor and control groups (3.50±0.789, 4.54±1.146, and 4.58±1.126); respectively, but all of them had pain during procedure in the mothers' recorded voice & breast milk odor and control groups (13.4±1.905, 15.8±1.399, and 15.8±1.399); respectively. But the mothers' voice recorded group with lower PIPP scores and a control group with higher PIPP scores for pain.

Table (3): Showed the mean differences in items of PIPP scale between three groups in four time frames. There was a highly statistically significant difference between mothers' voice recorded, breast milk odor, and control groups regarding heart rate & oxygen saturation at P< 0.0001 and the brow bulge as well as the eye squeeze at P< 0.005 but regarding behavioural state and nasolabial furrow, there was no statistically variation between the three groups..

Figure (3): Illustrated the mean differences in heart rate between three groups in four time frames. There was a highly statistically significant difference between mothers' voice recorded, breast milk odor, and control groups regarding heart rate at P< 0.0001. The mean alteration of heart rate during, immediately after and 5 m after ~~of~~ procedure among mothers' voice recorded group was fewest mean alteration. The greatest mean alteration of heart rate in control group was (161b/min) contrary to breast milk odor and mothers' voice recorded groups (155 and 149 b/ min respectively) immediately after procedure.

Figure (4): Illustrated the mean differences in oxygen saturation between three groups in four time frames. There was a highly statistically significant difference between mothers' voice recorded, breast milk odor, and control groups regarding oxygen saturation at P< 0.0001. The lowest mean alteration of (O_2) saturation was in the mothers' voice recorded group (97%) contrary to breast milk odor, and control groups (95% and 94% respectively) immediately after procedure.

Table (4): Revealed that there was a highly statistically significant mean difference between the studied sample regarding total PICS scores in three times (during, immediately after, and 5m after procedure) at P< 0.0001. Mothers' voice recorded group had the lowest total mean of PICS score compared to other two groups. All groups before the procedure were comfortable according to PICS Mean ± SD of mothers' recorded voice, breast milk odor and control groups (11.96±2.089, 13.12±1.520, and 13.7620±1.015); respectively but all of them were discomfortable during and immediately after procedure of mothers' recorded voice, breast milk odor and control groups (17.01±1.470, 18.72±1.294, and 19.30±0.974); respectively, but the mothers' voice recorded group have lower score and control group have the largest score of discomfort on PICS.

Table (4): Showed the mean differences in items of PICS between three groups in four time frames. There

was a statistically significant variation between the studied sample regarding calmness & crying at P< 0.005 but there wasn't a significant variance between the three participants groups related alertness, body movement, facial tension, and body muscle tone.

Discussion

The present study was conducted to evaluate the impact of mothers' voice recorded and breast milk odor on preterm baby's pain and comfort response during peripheral cannulation. The studied participant was a homogeneous group, The current study results regarding the demographic characteristics were congruent with the study of **Mater, et al., 2019** who had the same average of gestational age, A Apgar score, and the mean of birth weight .Also, the same study results was contradicted with our study results regarding diagnosis on admission which cleared that the majority of them had RDS. Furthermore, our study results were supported by **Alemdar, (2018)** who indicated that, the half of the studied sample was male.

The study provided further evidence that mothers' voice recorded and breast milk odor participants had low scores of pain than control participant group during peripheral cannulation, related PIPP pain scores. Mothers' voice recorded group had the lower mean of PIPP score during three-times. The findings of other studies strengthen these results by recorded that the intervention groups (recorded mother voice or breast milk odor) before any painful procedure as (peripheral cannulation, venipuncture, intravenous injection, and heel stick) in a favorable way altered the pain rating of preterm newborns both during and after the procedure **Yu, et al., 2022, Smith, et. al., (2018), Chirico, et al., (2017)**, all those studies found that the pain scores of the intervention group were significantly lower than those of the control group, and recommended them especially recorded mother voice may be a approach of nonpharmacological pain treatment, also researches done by **Alemdar & Özdemir (2017), and Bucsea & Riddell, (2019)** agree that there has been progress in our understanding of pain management in the NICU, but that there is still a significant chasm between our understanding of this topic and our actual practice, which results in insufficient non-pharmacological pain management.

It is obvious from the current study that there was a highly statistically significant mean difference regarding heart rate & O2 saturation; the current study results were supported by the result of the study done by **Williamson & McGrath (2019), who** evidenced preterm neonates who were exposed to maternal voice sound rather than maternal heart sound had significantly reduced rates of apnea and bradycardia compared to those exposed to maternal heart sound. **Kahraman, et al., (2020)** who mentioned that preterm newborns exposed to mother voices during a heel lance operation had considerably higher SO2 values than the control group, with no discernible impact on pain levels. Our study findings were contradicted with the research done by **Hatfield, et al., (2019)** who concluded that the impact of early procedural pain on subsequent pain responses in preterm neonates found that heart rate and O2 saturation variability was heightened.

The current study demonstrated that there was a significant variation between mothers' voice recorded, breast milk odor and control groups regarding brow bulge and eye squeeze, The study results were supported by **Mater, et al., (2019)** who cleared that there was a significant difference between intervention and control groups regarding brow bulge and eye squeeze. Furthermore, our study results were contradicted with the study by **Ibrahim, et al., (2016**) who found no statistically difference regarding brow bulge and eye squeeze between study and control group.

Regarding items of PIPP (behavioral state and nasolabial furrow), it was observed that there wasn't a significant variation between three participants groups; this result is congruent with **Ibrahim, et al., (2016)** who found no statistically significant regarding behavioral state and nasolabial furrow.

Enhancing newborns' comfort in the NICU is essential, and this includes both non-pharmacological and pharmaceutical approaches. Few studies analyze preterm newborns' comfort, and only one examined the influence of intervention (breast milk odor & recorded mother voice) on infants' comfort during the aspiration operation.

The current study reported that there was a highly statistically variation between mothers' voice recorded, breast milk odor, and control groups regarding total PICS scores in four times at P< 0.0001. Mothers' voice recorded group had the lowest total mean of PICS score compared to other two groups. This result comes in line with **Li, et al., (2022) & Küçük Alemdar& Güdücü Tüfekcİ, (2018),** who looked at how much pain preemie babies had during heel lancing found a substantial difference between pre- and post-procedure assessments.

The current study shows that there was a statistically significant difference between studied sample regarding calmness & crying at P< 0.005 but there wasn't a significant variation between the three participants groups regarding alertness, body movement, facial tension, and body muscle tone, this result was supported by **Efe, et al., (2022)** who found that preterm infants in intervention group were more calm and they cry less during the procedure

($p < 0.001$). From the researcher's point of view, mother's presence in the NICU should be encouraged, but when this is not possible, recording mother's voices & breast milk odor can be used as sensory stimulations to preterm infant & Nonpharmacological supportive interventions for short-term pain and making preterm infants more calming. In the same time, meeting the criteria of good clinical practice and the ethical needs of the NICU.

Conclusion

According to the study findings, the current study concluded that mothers' voice recorded and breast milk odor groups showed a significant reduction in total mean score of a suffering premature infant from pain and discomfort than control group during peripheral cannulation but mothers' voice recorded was more improved than breast milk odor with highly statistically significant differences. On the other hand, the mean difference of heart rate (pulse) and O_2 saturation in four-time frames among mothers' voice recorded group was the fewest mean changes, and also, the preterm infants in mothers' voice recorded were more calm and cry less.

Recommendations

In the light of the finding of current study, the following are recommended

Training program should be conducted in neonatal intensive care unit for health team members about mothers' voice recorded and breast milk odor techniques as it is a simple, safe, and supportive stimulus, secure and comfortable nursing practice for preterm infants. The findings of the current study should be transferred to the nurses working in various neonatal intensive care units as well as student nurses. The study should be replicated on large sample size

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