IJN
Iranian Journal of Neonatology
http://ijn.mums.ac.ir

Open Access

Original Article

Effect of Smell and Taste of Breast Milk and Sucrose on the Relief of Venipuncture Pain in Neonates: A Randomized Clinical Trail

Asieh Modaresi[1], Yadollah Zahedpasha[2], Seyedeh Roghayeh Jafarian_amiri[3*], Mahmoud Haji Ahmadi[4], Roya Farhadi[5]

1. Student Research Committee, Babol University of Medical Sciences, Babol, Iran
2. Department of Pediatrics, School of Medicine, Non-Communicable Pediatric Diseases Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, Iran
3. Nursing Care Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, Iran
4. Department of Epidemiology and Biostatistics, School of Public Health, Non-Communicable Pediatric Diseases Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, Iran
5. Pediatric Infectious Diseases Research Center, Mazandaran University of Medical Sciences, Sari, Iran

ABSTRACT

Background: Venipuncture is a common procedure in the neonatal department and causes significant pain for infants. This study aimed to compare the effect of tasting sucrose solution with those of smelling and tasting breast milk on the intensity of venipuncture pain in neonates.

Methods: This clinical trial was performed on 99 full-term neonates at Bouali Sina Hospital in Sari, Iran. The subjects were randomly divided into three groups of 24% sucrose(n:34), breast milk smell (n:31) and breast milk taste(n:34). Their venipuncture pain was measured using neonatal infant acute pain assessment scale (NIAPAS). The vital signs of neonates were monitored from two minutes before to 60 seconds after venipuncture. The data was analyzed using the Shapiro-Wilks, Chi-square, Kruskal-Wallis, at a significant level of 5%, and the Friedman tests.

Results: The mean scores of pain during venipuncture in the breast milk smell, breast milk taste, and sucrose groups were 7.22 ± 2.41, 8.58 ± 2.25, and 7.23 ± 2.61, respectively. The mean scores of pain 30 seconds after venipuncture in the breast milk smell and taste groups and the sucrose group were 2.25 ± 2.87, 4.41±4.30, and 2.70±3.18, respectively. The mean scores of pain 60 seconds after venipuncture in the breast milk smell and taste groups and the sucrose group were 0.45 ± 0.88, 1.55 ± 2.20, and 0.47 ± 0.96, respectively. The mean score of pain was significantly different at 30 and 60 seconds after venipuncture (P = 0.017 and 0.22, respectively).

Conclusion: The smell and taste of maternal breast milk, in case of lack of sucrose, were effective in the relief of venipuncture pain among hospitalized neonates. It is suggested to use these non-invasive and cost-effective methods to relieve the pain of newborns during painful treatment procedures, especially when the mother is not present in the ward.

Keywords: Breast milk, Pain, Sucrose, Term neonate, Venipuncture

Introduction

Pain is a matter of importance in neonates (1). The International Association for the Study of Pain defines pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage (2, 3). Infants, like children and adults, perceive pain (2), respond to it, and are more sensitive to painful stimuli compared to children. They are able to show strong physiological, behavioral, hormonal, and metabolic responses to such stimuli. These

* *Corresponding author*: Seyedeh Roghayeh Jafarian_amiri, Department of Medical & Surgical Nursing, School of Nursing & Midwifery, Babol University of Medical Sciences, Babol, Iran. Email: jafarianamiri@gmail.com

Please cite this paper as:
Modaresi A, Zahedpasha Y, Jafarian_amiri SR, Haji Ahmadi M, Farhadi R. Effect of Smell and Taste of Breast Milk and Sucrose on the Relief of Venipuncture Pain in Neonates: A Randomized Clinical Trail. Iranian Journal of Neonatology. 2024 Oct: 15(4). DOI: 10.22038/ijn.2024.80227.2545

responses can have short- and long-term destructive effects (4). Hospitalized infants are exposed to a large number of painful and stressful methods and since they are unable to express her pain, this leads to an underestimation of the pain and thus inadequate pain relief. adequate pain relief measures are not used for them(5).

Studies show that, on average, neonates experience 115 painful practices during a 16-day hospitalization period (6). Sources of pain in healthy term neonates include blood sampling for bilirubin and glucose measurements, phenyl-ketonuria screening, vitamin K injection, and hepatitis B vaccination before discharge (7). Peripheral venipuncture is one of the most common routine intervention methods and an important source of pain during neonate care(8). Pain increases the secretion of stress hormones (9), exacerbates tissue damage, prevents wound healing, and thus increases the risk of infection, length of hospital stay, and mortality (10). Acute responses of neonates to pain include behavioral, metabolic, and hormonal changes. Physiological indicators of pain include autonomic changes in heart rate, respiration, blood pressure, and SpO_2 (11). The long-term effects of infant pain are negative effects on growth and neurological development (9), increased sensitivity to pain and tension (6), behavioral and adaptation abnormalities in future (7).

Prevention, evaluation, and treatment of pain are among the important responsibilities of the medical staff (12). If a painful procedure is unavoidable, appropriate treatment using environmental, non-pharmacological and medicinal facilities is recommended (11). Non- pharma-ceutical methods for pain relief include breastfeeding, administration of oral sucrose, non-nutritive sucking, swaddling, kangaroo care, skin-to-skin contact, and music (13, 14).

In general, breastfeeding is known as an available, non-pharmaceutical, simple intervention in the relief of acute pain in neonates (15). The mechanism of this method of pain relief is multifactorial and includes sucking, skin-to-skin contact, warming, shaking, mother's voice and smell, and the possibility of the presence of endogenous opiates in breast milk (16).

The smells familiar to the infant, such as the smell of the mother, have a sedative effect on him/her (17). Olfactory stimulation by breast milk can be used to prevent pain in the neonatal intensive care unit (18).

Studies have shown that sweet solutions, such as sucrose or glucose, can reduce the behavioral responses to acute pain caused by medical procedures (19); in addition, administration of such solutions is a safe and ideal approach with limited side effects (11). Sucrose exerts its effect via stimulating specific receptors and reducing pain perception through endogenous opiates activity in the central nervous system (20). The recommended sucrose dosage for neonates over 37 weeks of gestation and under three months of age, weighing >2 kg is 2 mL with the action peak of two minutes (21, 22). Results of the study by Chaibi et al. on healthy term neonates using the Neonatal Infant Acute Pain Assessment Scale (NIAPAS) showed that the superior effectiveness of breastfeeding compared to glucose solution in relieving pain due to heel stick was 30% (23). In their study, Badiee et al. found that the score of pain during heel stick based on PIPP was significantly lower in premature neonates exposed to the smell of maternal breast milk compared to the ones exposed to the smell of formula (9). In the studies performed by Taplak and Erdem, after eye examination, the pain score was significantly higher in the control group than in the breast milk and sucrose groups. Infants in the breast milk group relaxed and returned to their mothers earlier than the ones in the sucrose group (24).

Various studies also examined the effects of sucrose, as well as the taste and smell of maternal breast milk on pain during different painful procedures. In the current study, the multidimensional NIAPAS was used and, to the best of the authors' knowledge, for the first time the effects of sucrose and smell and taste of maternal breast milk on venipuncture pain were compared. Considering the importance of pain and the destructive effects of unrelieved pain on the physical and mental health of the infant, the family, and finally the community, the present study was designed to suggest a safe, accessible, and inexpensive method for pain relief in hospitalized infants.

Methods

Design

This clinical trial (Reg. No. IRCT201708 21035820N1) was performed on 99 neonates admitted to the neonatal department of Bouali Sina Hospital in Mazandaran Province, Iran in 2018.

The inclusion criteria were: neonates with gestational age above 37 weeks, stability of vital signs, diagnosis of hyperbilirubinemia, age range of 2 to 29 days, full consciousness, 5-minute Apgar score >8, lack of receiving another painful procedure before the intervention, and not being fed within <30 minutes before the intervention.

The exclusion criteria were: having abnormalities in the head and skull, such as cleft palate and cleft lip, Cowan's atresia, receiving analgesics, sedatives, of anticonvulsants, contraindications to oral nutrition, withdrawal from participation in the study, and failure of first attempt for venipuncture. In our study, the primary outcome was pain and the secondary outcome was the duration of the neonate's crying.

Based on similar studies, using Altman's Nomograms with 95% confidence interval and 80% test power, 30 neonates were determined for each group.

Subjects were selected using the convenience sampling method until sample saturation. The samples were randomly assigned to three equal groups of A (maternal breast milk smell), B (maternal breast milk taste) and C (24% sucrose). Group allocation was as follows: sample number 1 in group A, sample number 2 in group B, sample number 3 in group C, sample number 4 in group A, etc (diagram 1).

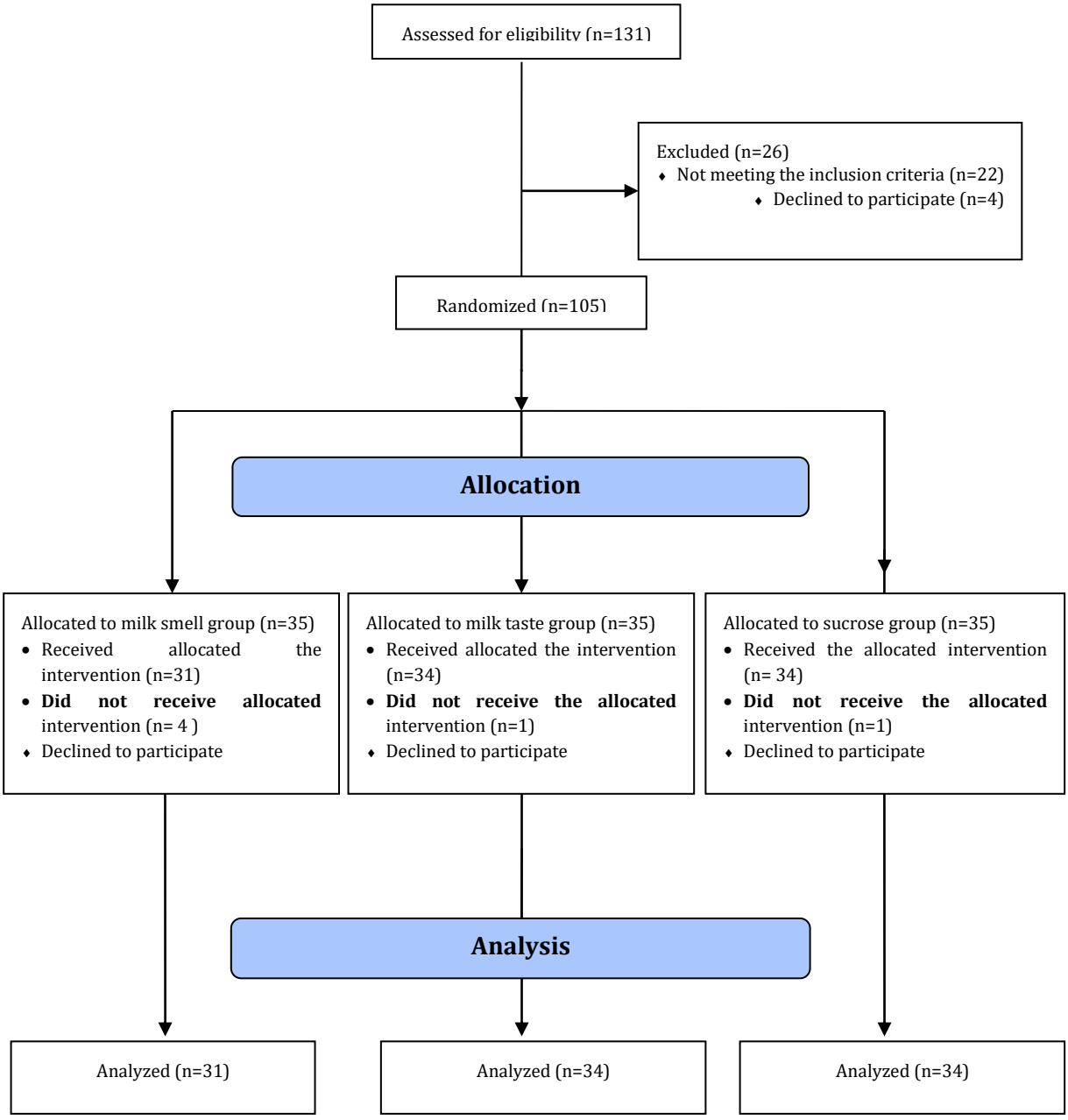

Diagram 1. Consort Flow Diagram

Data collection method

The current project was authorized by the Vice Chancellor of Babol University of Medical Sciences and the study protocol was approved by the university Ethics Committee (code: mubabol. hr2.rec.1396.9). Permission of the neonatal department authorities and written consent of the parents of the infants were obtained after the explanation of the study objectives and the intervention procedure. Neonates received routine care of the neonatal ward, diapers change, and feeding until 30 minutes before the intervention. At 6:00 to 7:00 AM, the subjects were placed in the supine position under a radiant heater at 36°C and continuous monitoring of heart rate and SpO_2 by a pulse oximeter (Masimo; USA) with a probe attached to the right wrist. In the sucrose group, 2 cc of 24% sucrose was poured into the front part of the neonate's tongue 2 minutes before the procedure. The solution used contained 24 mg of sucrose per milliliter prepared under sterile conditions. In the maternal breast milk taste group, 2 mL of milk expressed by the mother poured into the front part of the neonate's tongue 2 minutes before the procedure. In order to blind the subjects in the sucrose and breast milk taste groups, a cotton ball was placed near the neonates' nose. In the breast milk smell group, 2 mL of expressed milk was poured on cotton balls and placed near the subjects' nose for two minutes until 30 seconds before venipuncture procedure (25). Pain questionnaires were completed after reviewing and interpreting videos captured during the procedure, as well as 30 and 60 seconds after venipuncture (7). The procedure was performed by a well-trained person. A high-quality video camera (Canon SX 720) was used to record the response of the neonates to the venipuncture pain. After interpretation of the recorded videos, the subjects were monitored for physiological responses, behavioral patterns, facial expressions, and their pain scores were assigned by two experts (the researcher and a colleague familiar with the NIAPAS and its scoring method).

According to the study objectives, the data collection tools included a questionnaire and a pain scale. The questionnaire included seven items on gestational age, gender, birth weight, current weight, delivery method, age, and type of intervention, which was used to complete the infant's records. Pain was evaluated in the neonates by the NIAPAS, which consists of five behavioral (i.e., consciousness, facial expressions, crying, muscle contraction, and response to manipulation) and three physiological (i.e., changes in respiratory, heart rate, and SpO_2 patterns) indicators; gestational age is also considered as an underlying factor in this scale. Using NIAPAS makes it possible to categorize pain in an infant from painless to intensive pain, which is important to make decisions about pain management (11). The total score in NIPAS ranges from 0 to 18. Physiological indicators include change in heart rate 0 to 2 points (change in the number of beats compared to baseline as 0 to 5 beats = 0; 6 to 20 beats = 1; and >20 beats = 2), SpO_2 changes, 0 to 2 points (no change in the need for additional oxygen or an increase of 5% = 0; a change of 6% to 10% = 1; and a decrease up to 80% in spite of the extra oxygen supply = 2), and breathing change, 0 to 1 point (without change and compatible with gestational age = 0 and change in breathing = 1). Behavioral indicators include consciousness, 0 to 2 points (silent = 0; restless = 1; and severe restlessness= 2), facial expressions, 0 to 2 points (quiet and comfortable = 0; restless = 1; and gestures = 2), crying, 0 to 3 points (without crying = 0; sound discomfort = 1; calm cry = 2 and strong cry = 3), muscle tone, 0 to 1 point (no change = 0 and changed = 1), and the response to manipulation (lack of reaction = 0; a slight reaction to the touch = 1; and very stubborn and tilted mood = 2). The gestational age score also varies from 0 to 3 (7).

In the study of Polkky et al. (2014), psychometric analyses showed that the multidimensional NIAPAS was a valid and reliable tool with a very good content validity to assess acute pain in term and preterm infants. The NIAPAS also had high confidence coefficient (r = 0.991-0.997), internal confidence (r = 0.992-1.00), and internal consistency (0.723) in the current study (11).

SPSS version 21 was used to analyze the data. To determine the normality of data, the Shapiro-Wilks test, to determine the homogeneity of the groups, the Chi-square, to compare the intensity of pain among groups, the Kruskal-Wallis, at a significant level of 5%, and to determine infants' pain score at different time points, the Friedman test were used.

Ethical approval

The current project was authorized by the Vice Chancellor of Babol University of Medical Sciences and the study protocol was approved by the university Ethics Committee (code: mubabol. hr2.rec.1396.9).

Results

The findings showed that the three groups were homogeneous in terms of delivery method, infant age, gestational age, hospitalization age, gender, birth weight, and weight on admission (Table 1).

According to the results of the Friedman test, the pain score of neonates were significantly different at different time points in each of the three groups (P <0.001). The mean score of pain during venipuncture in the maternal breast milk smell, maternal breast milk taste, and sucrose groups were 7.22 ± 2.41, 8.58 ± 2.25, and 7.23 ± 2.61, respectively. Also, 30 seconds after venipuncture, the mean scores of pain in the maternal breast milk smell, maternal breast milk taste, and sucrose groups were 2.25 ± 2.87, 4.41±4.30, and 3.18 ± 2.70, respectively. Moreover, 60 seconds after venipuncture, the mean scores of pain in the maternal breast milk smell, maternal breast milk taste, and sucrose groups were 0.88 ± 0.45, 1.55± 2.20, and 0.47 ± 0.96, respectively. The pain score of the three groups was significantly different at different time points (P <0.001). The difference in the mean score of pain among three groups was not significant during venipuncture (P = 0.058), but was significant 30 and 60 seconds after venipuncture (P=0.022 and <0.017, respectively; (Chart 1, Table 2). The duration of crying was higher in the breast milk groups compared to the sucrose group (36.73 ± 27.36 vs 22.47 ± 17.79), but the difference was not significant (Table 3).

Table 1. The Scio-demographic/clinical characteristics of the participants

Variables		Smell of breast milk	Taste of breast milk	Sucrose	Significance level
Age (day)		7.6±4.51	9.32±7.66	7.16±4.39	0.52
Gestational age (weeks)		38.04±1.07	38.01±1.14	37.78±0.90	0.63
Birth Weight (g)		3189.03 ± 590.16	3089.12 ± 572.19	3044.71 ± 599.98	0.59
Hospital Weight (g)		2966.77 ± 557.98	2945.59 ±595.53	2892.65 ± 464.40	0.84
Gender	Male	16(51.6%)	17(50%)	19(55.9%)	0.88
	Female	15(48.4%)	17(50%)	15(44.1%)	
Delivery	*NVD	4(20.6%)	4(12.9%)	8(23.6%)	0.53
	**CS	27(79.4%)	27(79.4%)	26(76.4%)	

*Normal Vaginal Delivery
**Cesarean section

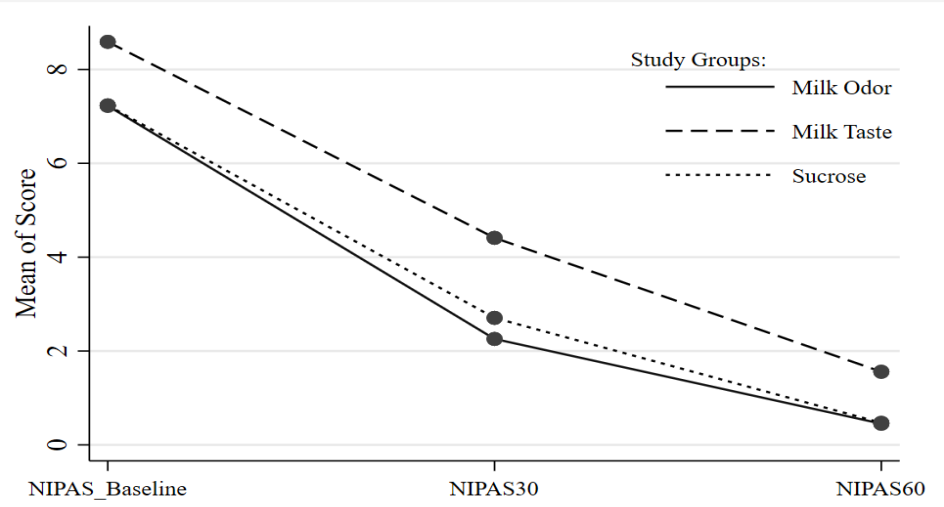

Chart 1. Pain score changes at different times in three groups

Table 2. The mean and standard deviation of neonatal pain score in the three study groups at different times

group	Time			
	NIPAS pain score during sampling	NIPAS pain score 30 seconds after sampling	NIPAS pain score 60 seconds after sampling	P-value Friedman test
Smell of breast milk	7.22 ± 2.41	2.25 ± 2.87	0.45 ± 0.88	<0.001
Taste of breast milk	8.58±2.25	4.41 ± 4.30	1.55 ± 2.20	<0.001
Sucrose	7.23± 2.61	2.70± 3.18	0.47±0.96	<0.001
P-Value	0.058	0.022	0.017	

Table 3. Comparison of mean and standard deviation of duration of crying in the groups

Group	Smell of breast milk	Taste of breast milk	Sucrose	Kruskal-Wallis test	Degree of freedom	P-value
	Mean ± SD	Mean ± SD	Mean ± SD			
Duration of crying	28.93± 30.94	36.73±27.36	22.47±17.79	5.431	2	0.06

Discussion

According to the results, the pain score of neonates at different time points was significantly different among the three groups. There was no significant difference in the mean score of pain among the groups during venipuncture, but it was significantly different at 30 and 60 seconds after venipuncture. Infants in all the three groups experienced the most intense pain during venipuncture. Pain scores in the maternal breast milk smell and sucrose groups were similar and in the breast milk taste group it was higher than the other two groups, but the difference between the groups was insignificant in terms of the mean score of pain during the venipuncture, which was consistent with the results of the study by Ou-Yang et al. They used expressed maternal milk and glucose solution in their study and reported that 30 seconds after venipuncture, newborns in the breast milk taste group experienced the highest pain, but the breast milk smell group had the lowest pain. Similarly, 60 seconds after venipuncture, the breast milk smell group had the highest and the breast milk taste group experienced the lowest level of pain (26).

In the study by Motta and Cunha, the use of sweet solutions was associated with reduced duration of crying, reduced facial pain signs, less heart rate increase, and decreased pain score (15), which is consistent with the present findings. Also, in the study by Sethi and Nayak, infants who received 24% sucrose two minutes prior to venipuncture had a significantly lower NIPAS score than the control group (27). According to studies, the 24% sucrose pain relieving mechanism of action most likely relates to the release of endogenous opioids with direct control over pain, or oral-gastrointestinal stimulation of sweet taste receptors located on the front of the tongue, which release the endogenous morphine and slow down response to pain (28, 29). A study by Chiyabi et al., on healthy term neonates older than 24 hours showed superior effectiveness of breastfeeding over oral 30% glucose during heel prick blood sampling. The mean score of pain in the breastfeeding group was significantly lower than the glucose group (P <0.001) (29). However, in the present study, the pain score of the sweet solution group was lower than those of the breast milk groups. This result can confirm the multifactorial effect of breastfeeding on pain relief compared to expressed maternal milk.

Yen et al. also showed in their study that the combination of non-nutritive sucking, placing the infant in a comfortable position, and oral sucrose methods was more effective than any of them alone (30). Thus, most control over painful stimuli in neonates occurs in skin-to-skin contact and breastfeeding, but under certain circumstances that mother's presence is not possible, maternal expressed milk can be used as a valuable pain-relieving agent. In the study by Sabeti et al. aiming to compare the effects of glucose, lidocaine, and expressed milk before venipuncture in term neonates, DAN pain score and pulse rate were significantly lower in the expressed maternal milk group compared to that of the glucose group (31). Results of the study by Tarhani et al. on venipuncture in term neonates showed that pain score was significantly lower in infants fed with maternal expressed milk than in their counterparts fed with formula and dextrose 50% (25). In their study, behavioral response to pain was measured by DAN scale, while in the scale used in the study by .

Hsieh et al. studied the effect of non-pharmacological interventions on pain due to medical procedures in preterm infants. Pain score based on PIPP in the breast milk group was significantly lower than that in the control group during and after the procedure, but this difference was not significant between the breast milk and 10% dextrose groups at any of the time points (32), which is consistent with the present study findings. In the present study, the pain-relieving effect of breast milk smell was studied. Olfactory stimulation can clinically have beneficial effects on neonates in terms of prevention of sleep apnea, reduction of pain and maternal separation responses, and improvement of sucking patterns and faster coordination between oral feeding mechanisms and, consequently, early discharge from hospital (3.4 days on average) (33).

According to the results of the current study, neonates can detect the smell of their own mothers' breast milk and respond to it, and the smell of maternal breastmilk can reduce the effects of painful procedures in the newborn. According to the results of the study by Nishitani et al., the smell of maternal breast milk reduces

the sensation of pain during venipuncture (34). In the study by Badiee et al., PIPP pain score was significantly lower in the smell of breast milk group compared to the smell of formula group (9). The study by Rataz et al. showed that crying, head movements, and facial expression changes in the infants exposed to the smell of breast milk were significantly lower than those in the control group (35). All of these results indicate the sedative effects of smell of maternal breast milk that was also found in the current study.

Using a simple, convenient, safe, and practical technique for procedural pain relief in neonates that can be considered for other painful procedures. is one of the strengths of this study. Of the current study limitations, lack of comparison of premature and term newborns with other diagnoses is noteworthy. The study could not be performed in the neonatal intensive care unit and only neonates admitted to the neonatal department with hyperbilirubinemia were enrolled. Some mothers did not attempt timely pumping of their milk because of lack of rest and pain. Due to crowdedness and lack of staff in the department, sometimes simultaneous venipuncture and video recording was impossible. Some mothers did not let authors to take video of their infants. A number of mothers required more details about the reasons of the study procedure and attachment of the monitor to their infants, which was interfering with routine measures of department due to the high work load and lack of time.

Conclusion

The results of the current study suggest that the use of smell and taste of maternal breast milk has high and almost similar effectiveness in case of lack of access to sucrose solution in the relief of pain in newborns undergoing a painful procedure. It is worth mentioning that the smell of breast milk was more effective in comparison with its taste in the current study. The current study results showed that the use of expressed breast milk in the absence of the mother for various reasons such as hospitalization or cesarean sectional pain, even in the case of prohibition of oral feeding, is effective in the relief of pain in neonates, and the smell of maternal breast milk can be used as a method to relieve pain in painful procedures, such as venipuncture.

Acknowledgments

Acknowledgments: The authors hereby acknowledge their gratitude to the Deputy of Research of Babol University of Medical Sciences for approval of the project and itsl support. We also wish to thank the parents of infants, nurses, and head of neonatal department at Bouali Sina Hospital in Sari for their cooperation with us in conducting this study.

Funding

We did not receive any funding to carry out this study.

Conflicts of interest

The authors declare that they have no conflicts of interests.

References

1. Mehrnoush N, Ashktorab T, Heidarzadeh M, Momenzadeh S, Khalafi J. Pain management perceptions of the neonatal nurses in NICUs and neonatal units in Ardebil, Iran. Iran J Neonatol. 2016;7(4):23-29.
2. Verklan MT, Walden M. Core curriculum for neonatal intensive care nursing. 5th ed. New York: Elsevier Health Sciences; 2014:316-328.
3. Baarslag MA, Allegaert K, Van Den Anker JN, Knibbe CA, Van Dijk M, Simons SH, et al. Paracetamol and morphine for infant and neonatal pain; still a long way to go? Expert Rev Clin Pharmacol. 2017;10(1):111-126.
4. Cruz MD, Fernandes AM, Oliveira CR. Epidemiology of painful procedures performed in neonates: A systematic review of observational studies. Eur J Pain. 2016;20(4):489-498.
5. Rocha VA, Silva IA, da Silveira Cruz-Machado S, Bueno M. Painful procedures and pain management in newborns admitted to an intensive care unit. Rev Esc Enferm USP. 2021;55:e20210232. English, Portuguese.
6. Pölkki T, Korhonen A, Laukkala H. Nurses' Perceptions of pain assessment and management practices in neonates: A cross-sectional survey. Scand J Caring Sci. 2018;32(2):725-733.
7. Ranger M, Chau CM, Garg A, Woodward TS, Beg MF, Bjornson B, et al. Neonatal pain-related stress predicts cortical thickness at age 7 years in children born very preterm. PLoS One. 2013;8(10):e76702.
8. Wu HP, Yin T, Hsieh KH, Lan HY, Feng RC, Chang YC, et al. Integration of different sensory interventions from mother's breast milk for preterm infant pain during peripheral venipuncture procedures: A prospective randomized controlled trial. J Nurs Scholarsh. 2020 Jan;52(1):75-84.
9. Badiee Z, Asghari M, Mohammadizadeh M. The calming effect of maternal breast milk odor on premature infants. Pediatr Neonatol. 2013;54(5): 322-325.
10. Polkki T, Korhonen A, Axelin A, Saarela T, Laukkala H. Development and preliminary validation of the Neonatal Infant Acute Pain Assessment Scale

(NIAPAS). Int J Nurs Stud. 2014;51(12):1585-1594.
11. Roue JM, Kuhn P, Lopez Maestro M, Maastrup RA, Mitanchez D, Westrup B, et al. Eight principles for patient-centred and family-centred care for newborns in the neonatal intensive care unit. Arch Dis Child Fetal Neonatal Ed. 2017;102(4):F364-F368.
12. Zhu J, Hong-Gu H, Zhou X, Wei H, Gao Y, Ye B, et al. Pain relief effect of breast feeding and music therapy during heel lance for healthy-term neonates in China: A randomized controlled trial. Midwifery. 2015;31(3):365-372.
13. Harrison D, Bueno M, Reszel J. Prevention and management of pain and stress in the neonate. Res Rep Neonatol. 2015;5:9-16.
14. Danaie M, Yeganegi M, Dastgheib SA, Bahrami R, Jayervand F, Rahmani A, et al. The interaction of breastfeeding and genetic factors on childhood obesity. Eur J Obstet Gynecol Reprod Biol X. 2024;23:100334.
15. da Motta Gde C, da Cunha ML. Prevention and non-pharmacological management of pain in newborns. Rev Bras Enferm. 2015;68(1):123-7, 31-5. English, Portuguese.
16. Harrison D, Reszel J, Bueno M, Sampson M, Shah VS, Taddio A, et al. Breastfeeding for procedural pain in infants beyond the neonatal period. Cochrane Database Syst Rev. 2016;10:CD011248.
17. Marofi M, Nikobakht F, Mohammadi Nasrollah A, Badiei Z. Comparing the effect of listening to melody vs. breast-feeding on neonates'pain intensity during heel-blood sampling in neonatal intensive care unit. J Anesthesiol Pain. 2015;5(3):45-54.
18. Baudesson de Chanville A, Brevaut-Malaty V, Garbi A, Tosello B, Baumstarck K, Gire C. Analgesic effect of maternal human milk odor on premature neonates: A randomized controlled trial. J Hum Lact. 2017;33(2):300-308.
19. Harrison D, Larocque C, Bueno M, Stokes Y, Turner L, Hutton B, Stevens B. Sweet Solutions to Reduce Procedural Pain in Neonates: A Meta-analysis. Pediatrics. 2017 Jan;139(1):e20160955.
20. Thakkar P, Arora K, Goyal K, Das RR, Javadekar B, Aiyer S, et al. To evaluate and compare the efficacy of combined sucrose and non-nutritive sucking for analgesia in newborns undergoing minor painful procedure: A randomized controlled trial. J Perinatol. 2016;36(1):67-70.
21. Stevens B, Yamada J, Lee GY, Ohlsson A. Sucrose for analgesia in newborn infants undergoing painful procedures. Cochrane Database Syst Rev. 2013(1):CD001069.
22. Morash D, Fowler K. An evidence-based approach to changing practice: using sucrose for infant analgesia. J Pediatr Nurs. 2004;19(5):366-370.
23. Chiabi A, Eloundou E, Mah E, Nguefack S, Mekone IN, Mbonda E. Evaluation of breastfeeding and 30% glucose solution as analgesic measures in indigenous African term neonates. J Clin Neonatol. 2016;5(1):46-50.
24. Sener Taplak A, Erdem E. A comparison of breast milk and sucrose in reducing neonatal pain during eye exam for retinopathy of prematurity. Breastfeed Med. 2017;12:305-310.
25. Tarhani F, Dalvand S, Tarrahi MJ, Ahmadi M. Analgesic effect of expressed breast milk in neonates during venipuncture in comparison with formula and 50% dextrose. Sci Mag Yafte. 2013;14(5):23-28.
26. Ou-Yang MC, Chen IL, Chen CC, Chung MY, Chen FS, Huang HC. Expressed breast milk for procedural pain in preterm neonates: A randomized, double-blind, placebo-controlled trial. Acta Paediatr. 2013;102(1):15-21.
27. Sethi R, Nayak G. Effect of 24% oral sucrose in pain reduction during venipuncture in neonates. Asian J Nurs Educ Res. 2015;5(4):457-460.
28. Hall RW, Anand KJ. Pain management in newborns. Clin Perinatol. 2014;41(4):895-924.
29. Committee on Fetus Newborn, Section on Anesthesiology Pain Medicine. Prevention and management of procedural pain in the neonate: An update. Pediatrics. 2016;137(2):e20154271.
30. Yin T, Yang L, Lee TY, Li CC, Hua YM, Liaw JJ. Development of atraumatic heel-stick procedures by combined treatment with non-nutritive sucking, oral sucrose, and facilitated tucking: A randomised, controlled trial. Int J Nurs Stud. 2015;52(8):1288-1299.
31. Sabety F, Yaghoobi M, Torabizadeh M, Javaherizadeh H, Haghighizadeh MH, Muhammadian F. Which is better for pain reduction before venipuncture: glucose, lidocaine or expressed breast milk. J HK J Paediatr. 2013;18:19-23.
32. Hsieh KH, Chen SJ, Tsao PC, Wang CC, Huang CF, Lin CM, et al. The analgesic effect of non-pharmacological interventions to reduce procedural pain in preterm neonates. Pediatr Neonatol. 2018;59(1):71-76.
33. Cao Van H, Guinand N, Damis E, Mansbach AL, Poncet A, Hummel T, et al. Olfactory stimulation may promote oral feeding in immature newborn: A randomized controlled trial. Eur Arch Otorhinolaryngol. 2018;275(1):125-129.
34. Nishitani S, Miyamura T, Tagawa M, Sumi M, Takase R, Doi H, et al. The calming effect of a maternal breast milk odor on the human newborn infant. Neurosci Res. 2009;63(1):66-71.
35. Rattaz C, Goubet N, Bullinger A. The calming effect of a familiar odor on full-term newborns. J Dev Behav Pediatr. 2005;26(2):86-92.