

## A Systematic Review of the Efficacy of Aromatherapy on Reducing the Duration of Hospitalization of Preterm Infants

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### Abstract

**Background:** Advances in medical science and nursing care today have led to the survival of preterm infants. Therefore, it is important to address methods to reduce the duration of hospitalization of preterm infants. Aim of the systematic review on the efficacy of aromatherapy on reducing the duration of hospitalization of preterm infants.

**Materials and Methods:** Systemic search of online databases (Medline (via PubMed), Web of Science, Cochrane, International Registry Platform for ongoing trials and clinical trials.gov, and EMBASE complete for randomized control trial and non-randomized prospective or retrospective clinical studies published with no time limit till Feb 2019. Study selection was done by two reviewers.

**Results:** Five studies were included into systematic review. In the first study, 50 infants were divided into odorless and odor-stimulated (by anise or cinnamon) groups. The mean duration of discharge in the olfactory stimulation group was 3.4 days earlier than the odorless group ( $p=0.12$ ). In the second study, the time spent in the hospital was significantly shorter in the milk-odor (43 days) than control group (55.5 days). In the second study, length of stay in hospital was shorter in premature infants in neonatal intensive care units exposing impregnated pad than control in the fourth study, the result of their study showed olfactory stimulation with vanilla but not rose decreased length of stay in hospital than control group. In the last study, duration of hospitalization was shorter in the Odor of breast milk group in comparison with control group.

**Conclusion:** According to the results of the present study, the olfactory stimulation of preterm infants can be effective in reducing the duration of hospitalization.

**Key Words:** Aromatherapy, Duration of Hospitalization, Preterm Infants.

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## 1- INTRODUCTION

Preterm birth refers to the birth of a baby before 37 weeks of pregnancy regardless of birth weight (1). Global health statistics in 2003 reported that 12.3% of all births were preterm (2). Prolonged exposure of a preterm infant in the stressful environment of the neonatal intensive care unit (NICU) increases the risk of lifelong disabilities (LLDs), and other health conditions requiring lifelong care (2). Numerous studies in recent years have shown that preterm birth is one of the major causes of neurodevelopmental disorders that have been inversely related to gestational age and birth weight (3). Due to the high cost of care for these infants and the many neurophysiological problems resulting from various causes, postnatal care of these infants has been the focus of researchers for the past several decades, in that they have sought to promote the development of this infant by using different methods (4).

Advances in medical science and nursing care today have led to the survival of preterm infants, which means an increase in the number of infants in need of interventional care and special support aimed at reducing disability, facilitating the growth and development of these infants (5). Advances in clinical trials on neonates have consistently been directed toward increasing the survival of preterm infants; especially those with very low birth weight, highlighting the necessity of focus on strategies to promote treatments and outcomes. In this regard, providing timely and appropriate enteral feeding for preterm infants is one of the main goals. Non-coordination of sucking-swallowing-breathing and inadequate sucking results in preterm infants being fed by gavage (6). Some studies reported the efficacy of aromatherapy on reducing the duration of hospitalization of preterm infants in the first study (1, 6-9).

One of the effective indicators that can be used for hospital care management, quality control of hospital care, up-to-date hospital services, policies and hospital planning, determining the efficiency and utilization of hospital resources, is the use of hospital length of stay (10-12). Reducing the length of hospital stay has many benefits, such as lowering hospital costs, increasing the quality of services provided, and increasing economic benefits for communities (13). The cost of health care is increasing day by day and prolonged hospital stays increase the burden of these costs (14). Accordingly, hospital policymakers, policymakers and insurers are increasingly seeking to reduce hospital stays to reduce hospital costs while increasing hospital capacity to accommodate patients in need of hospital care (15, 16). The aim of this study was to review the effectiveness of aromatherapy on reducing the duration of hospitalization in preterm infants.

## 2- MATERIALS AND METHODS

In this systematic review, Preferred Reporting Items for Systematic review and Meta-Analysis (PRISMA) checklist were used as a template for this review (<http://prisma-statement.org/>).

### 2-1. Included studies

Randomized controlled trials (RCT), clinical studies both randomized and nonrandomized either retrospective or prospective were included. Due to the limited number of published RCT in the literature, other types of clinical studies were included. Pilot, preliminary and case report studies were not included due to limited sample size and higher risk of bias. Studies published in Persian and English with no time limit till February 2019.

### 2-2. Information sources

Systemic research of electronic databases: Medline (via PubMed), Web of Science, Cochrane, International Registry Platform

for ongoing trials and clinical trials.gov, and EMBASE complete.

**2-3. Search**

Search words were a combination of: (Aromatherapy OR olfactory) AND (hospitalization OR hospital) AND (preterm OR premature).

**2-4. Study selection**

Database search was done for possible studies, abstracts of the studies were screened for identification of eligible studies, full text articles were obtained and assessed and a final list of included studies was made. This process was done independently and in duplication by two reviewers and any disagreement was resolved by the 3<sup>rd</sup> reviewer. We also manually searched References of articles and reviews to find further related research.

**2-5. Data collection process**

We developed a form and followed it for each study. Two reviewers collected the data independently, the collected data was combined and compared for accuracy and any discrepancies were solved by a third

reviewer. Data collected from the selected studies included: study design, name of authors, year of publication, study population, assessment tool, and first hospitalization based on two groups, drop out, and outcomes (**Table.1**) (Please see the table at the end of paper).

**2-6. Quality assessment of included studies**

To evaluate the quality of the studies obtained by searching, Jadad scale (17) was utilized which consists of randomization techniques, randomization, blinding, blinding techniques, and withdrawals and omissions (**Table.2**). The assessment was carried out by two reviewers independently and in duplication, any discrepancies were resolved by the third reviewer.

**2-7. Synthesis of results**

Due to the difference in the included studies, study designs, lack of control groups in some studies, sample size, type of intervention used, and duration of treatment meta-analysis was not conducted.

**Table-2:** Quality Assessment using Jadad scale (17).

Authors, Reference	Randomization			Blinding			Report of dropping out
	Mention randomization	Appropriate method	Inappropriate Method	Mention blinding	Appropriate method	Inappropriate method	
Yildiz et al., 2011, (1)	😊	😊	😡	😡	😡	😡	😡
Schriever et al., 2018, (6)	😐	😡	😡	😐	😡	😡	😊
Cao Van et al., 2018, (7)	😊	😊	😡	😊	😊	😡	😊
Raimbault et al., 2007, (8)	😡	😡	😡	😡	😡	😡	😡
Iranmanesh et al., 2015, (9)	😊	😊	😡	😊	😊	😡	😡

😊 : Yes; 😡 : No; 😐 : Unclear.

**3- RESULTS**

Five studies were included into systematic review (1, 6-9). Van et al. allocated 50 infants into odorless and

odor-stimulated (by anise or cinnamon) groups. The duration of hospitalization was the main outcome. The mean duration of discharge in the olfactory stimulation group was 3.4 days earlier

than the odorless group ( $p=0.12$ ). There was statistically significant difference ( $p<0.05$ ) between more mature newborns ( $n=39$ ) in the analysis, thereby highlighting the olfaction potential in early stimulation of feeding (7). In a study by Raimbault et al., the time spent in the hospital was significantly shorter in the milk-odor (43 days) than control group (55.5 days) (8). In Iranmanesh et al.'s study, length of stay in hospital was shorter in premature infants in neonatal intensive care units exposing impregnated pad than control (9). Schriever et al. compared the effectiveness of vanilla but not rose. The result of their study showed olfactory stimulation with vanilla but not rose decreased length of stay in hospital than control group (6). Yildiz et al. compared the effect of the odor of breast milk on the time switched from gavage to total oral feeding in preterm infants. Duration of hospitalization was shorter in the Odor of breast milk group in comparison with control group (1).

#### 4- DISCUSSION

We aimed to review the effectiveness of aromatherapy on reducing the duration of hospitalization in preterm infants. The findings of the present review article revealed that the olfactory stimulation of preterm infants reduces the duration of hospitalization. The preterm birth is one of the main and most common causes of neonatal hospitalization (1). The preterm infants need hospitalization for a variety of reasons, especially in the NICU (18). Reducing the duration of hospitalization of the infants has a significant effect on reducing the cost of provided care, the risk of nosocomial infections, and the problems of parent-infant emotional relationship as well as accelerating the infant growth (19). Feeding status is very important in the prognosis and duration of hospitalization of preterm infants; however, the preterm infants under 34

weeks of age have insufficient coordination between breathing, sucking and swallowing, and therefore gavage feeding is usually considered as an indication (18). Failure in the gastrointestinal tract of infants causes delay in the onset of oral feeding and consequently prolongs the duration of hospitalization of preterm infants (20). Indeed, there is a relationship between the transition from gavage to oral feeding and the duration of hospitalization, thereby affecting the physiological health of preterm infants (9). Therefore, strengthening sensory-motor-oral skills in preterm infants is crucial for gaining control of oral feeding. Olfaction is one of the senses that functions well in preterm infants (21). Also, olfactory stimulation can accelerate the growth and development of their feeding.

The olfactory stimulation reinforces the non-nutritive sucking behavior of infants. Improved sucking skill reduces the transition time from gavage to oral feeding as well as the duration of hospitalization (1). The olfaction of infant can be triggered by the smell of maternal breast milk or other substances. Maternal odor plays a role in facilitating infant initiation of breastfeeding toward the mother's nipple and stimulating infant's sucking movements, which are in fact stereotypical components of infants' feeding behavior (22-25). Raimbault et al. (2007) showed that the exposure of preterm infants to breast milk smell improved the infant behaviors and increased the infant milk intake, as well as decreased the duration of hospitalization in these infants. They found that infants' feeding behaviors and skills were significantly faster in the infants exposed to the breast milk smell, which is a very important indicator of discharge (8). Yildiz et al. (2011) reported that the olfactory stimulation of the preterm infants with the breast milk

during gavage caused the transition from gavage to oral feeding earlier than the control group, as well as shorter duration of hospitalization. The researchers attribute this finding to the development of sucking skills in this group of preterm infants, which results in an earlier oral feeding (1). Iranmanesh et al. (2015) found that the olfactory stimulation of preterm infants with the breast milk resulted in a 10-day decrease in the transition time from gavage to oral feeding as well as a 12-day decrease in the duration of hospitalization (9). Lee (2019) showed that the olfactory stimulation of the infants with the breast milk without exerting distress and disrupting their physiological responses, such as oxygen saturation or heart rate, decreased gastric digestion function in the preterm infants (26). The olfactory stimulation of infant breast milk appears to be effective in accelerating the transition from gavage to oral feeding and the discharge. Schriever et al. (2018) acknowledged that the olfactory stimulation of preterm infant with the breast milk is routinely performed in the pediatric wards, and the device used for olfactory stimulation with breast milk should be prepared prior to lactation, and suggested the use of other methods of olfactory stimulation for these infants (6). They compared the effects of aromatherapy with rose, vanilla, and placebo on the transition time from gavage to oral feeding, and reported that the olfactory stimulation of preterm infants with vanilla reduced the duration of gavage feeding and the duration of hospitalization. In this study, the aromatherapy with rose, unlike vanilla, had no effect on infants' feeding process. Researchers know the reason for the difference, perhaps because vanilla is an edible essential oil, and it is likely to be used by the mother during pregnancy and to be identified by the fetus during ingestion of amniotic fluid, while roses

are less commonly used. The vanilla, on the other hand, may be involved in stimulating appetite, while no such effect has been reported for the rose (6). Van et al. (2018) demonstrated that the olfactory stimulation of preterm infants by combining cinnamon and anise can be effective in reducing the duration of hospitalization of preterm infants and the transition time from gavage to oral feeding (7).

## 5- CONCLUSIONS

According to the results of the present study, the olfactory stimulation of preterm infants can be effective in reducing the duration of hospitalization. Accordingly, nurses in the pediatric wards and NICU are advised to use this simple, low-cost and effective method. In addition, further studies are recommended to determine the best effective agent for the olfactory stimulation of preterm infants.

**6- CONFLICT OF INTEREST:** None.

## 7- REFERENCES

1. Yildiz A, Arikan D, Gözüm S, Taştekin A, Budancamanak İ. The effect of the odor of breast milk on the time needed for transition from gavage to total oral feeding in preterm infants. *Journal of Nursing Scholarship*. 2011;43(3):265-73.
2. Harrison D, Bueno M, Reszel J. Prevention and management of pain and stress in the neonate. *Res Rep Neonatol*. 2015;5:9-16.
3. Pados BF, McGlothen-Bell K. Benefits of Infant Massage for Infants and Parents in the NICU. *Nursing for women's health*. 2019;23(3):265-71.
4. Karbandi S, Boskabadi H, Esmaily H, Kalateh MM. Effects of massage on duration of phototherapy in premature infants admitted to a neonatal intensive care unit. 2016.
5. Eshghi F, Bostani S. The effect of Gentle Human Touch on behavioral states in preterm infants. 2019.

6. Schriever VA, Gellrich J, Rochor N, Croy I, Cao-Van H, Rüdiger M, et al. Sniffin'away the feeding tube: The influence of olfactory stimulation on oral food intake in newborns and premature infants. *Chemical senses*. 2018;43(7):469-74.
7. Cao Van H, Guinand N, Damis E, Mansbach A-L, Poncet A, Hummel T, et al. Olfactory stimulation may promote oral feeding in immature newborn: a randomized controlled trial. *European archives of oto-rhino-laryngology*. 2018;275(1):125-9.
8. Raimbault C, Saliba E, Porter RH. The effect of the odour of mother's milk on breastfeeding behaviour of premature neonates. *Acta paediatrica*. 2007;96(3):368-71.
9. Iranmanesh S, Shamsi A, pour Aboli B, Movahedi Z. The effect of breast milk odor on transition time from gavage to oral feeding and hospital stay in premature infants. *ICAN: Infant, Child, and Adolescent Nutrition*. 2015;7(1):5-11.
10. Clarke A. Length of in-hospital stay and its relationship to quality of care. *Quality and Safety in Health Care*. 2002; 11: 209-10.
11. Ghoreishi Nejad S. Agent simulation in healthcare, in ProQuest® Dissertations & Theses. Canada: University of Regina; 2008.
12. Atienza N, García-Heras J, Muñoz-Pichardo J, Villa R. An application of mixture distributions in modelization of length of hospital stay. *Statistics in medicine*. 2008; 27: 1403-20.
13. Herrle G. Reducing inpatient length of stay: the time has come to revisit this discarded strategy. Available at: <http://publications.milliman.com/research/healthrr/pdfs/Reducing-InPatient-Length-Stay-CC.pdf>.
14. Vegas A, Jodra V, Garsia ML, Nosocomial infection in surgery wards: a controlled study of increased duration of hospital stays and direct cost of hospitalization. *European journal of epidemiology*, 1993;9: 504-10.
15. Nicholls AG, Young FR. Innovative hospital bed management using spatial technology: Spatial Sciences Institute (Queensland); 2007.
16. Cannooddt L, Knickman JR. The effect of hospital characteristics and organizational factors on pre-and postoperative lengths of hospital stay. *Health Services Research*, 1984; 19: 561-585.
17. Jadad AR, Moore RA, Carroll D, Jenkinson C, Reynolds DJM, Gavaghan DJ, et al. Assessing the quality of reports of randomized clinical trials: is blinding necessary? *Control Clin Trials*. 1996;17(1):1-12.
18. Rocha AD, Moreira MEL, Pimenta HP, Ramos JRM, Lucena SL. A randomized study of the efficacy of sensory-motor-oral stimulation and non-nutritive sucking in very low birthweight infant. *Early human development*. 2007;83(6):385-8.
19. Asadollahi K, Mussavi M, Hosseini M. The Impact of Early Discharged of Stable Preterm Neonates with Home Gavage Feeding; A Case Control Study. *International Journal of Pediatrics*. 2018;6(2):7141-9.
20. Jadcherla SR, Shaker R. Esophageal and upper esophageal sphincter motor function in babies. *The American journal of medicine*. 2001;111(8):64-8.
21. Nakashima T, Kimmelman CP, Snow JB. Structure of human fetal and adult olfactory neuroepithelium. *Archives of otolaryngology*. 1984;110(10):641-6.
22. Russell MJ. Human olfactory communication. *Nature*. 1976;260(5551):520.
23. Varendi H, Porter R, Winberg J. Does the newborn baby find the nipple by smell? *The Lancet*. 1994;344(8928):989-90.
24. Porter R, Winberg J. Unique salience of maternal breast odors for newborn infants. *Neuroscience & Biobehavioral Reviews*. 1999;23(3):439-49.
25. Varendi H, Porter R. Breast odour as the only maternal stimulus elicits crawling towards the odour source. *Acta Paediatrica*. 2001;90(4):372-5.
26. Lee EJ. The Effects of Breast Milk Olfactory Stimulation on Physiological Responses, Oral Feeding Progression and Body Weight in Preterm Infants. *Journal of Korean Academy of Nursing*. 2019;49(2):126-36.

**Table-1:** Some demographic and clinical characteristics of the studies included in the systematic review.

Study, Year, Country, Reference	Study design	Aromatherapy type	Outcomes	Subjects	Intervention	Control	Drop out	Assessment tool	Results
Yildiz et al., 2011, Turkey (1)	Prospective experimental study	Milk-odor	Transition time from gavage to oral feeding and hospital stay	40/40	The stimulus of breast milk started with feeding by placement of a sterile pad soaked in breast milk 2 cm from the infant nose.	No	-	Self-records	Stimulation with breast milk odor is an effective method for decreasing transition of preterm infants from gavage and shortened the hospitalization time.
Schriever et al., 2018, Germany (6)	Prospective randomized controlled	Vanilla and Rose aroma	Duration between study entry and complete oral food intake defined as solely oral feeding for at least 24 hours	150	Odors were presented to the infants before each feeding. The "Sniffin' Sticks" were used for odor.	Odorless probe	10%	Self-records	Olfactory stimulation with vanilla but not rose decreased length of stay in hospital than control group.
Cao Van et al., 2018, Belgium (7)	Prospective single-blind randomized controlled study	Milk-odor	The duration of admission to the NICU unit and hospital discharge	25/24	The olfactory stimulation consisted in moving a scented pen under the nose of the child during 10 seconds before each meal, regardless of the feeding modality or an odorless pen for the control group.	No	2%	Self-records	Olfactory stimulation of premature newborns may promote coordination of oral feeding mechanisms and favor earlier hospital discharge.
Raimbault et al., 2007, France, (8)	Randomized controlled trial	Milk-odor	Breastfeeding behavior Release from NICU	7/6	Throughout the daily exposure sessions, the infant remained in the mother's arms and a cotton-tipped applicator moistened with the stimulus liquid was held ~1 cm from the baby's nostrils.	Water	-	Hand-held VCR	Exposure to the odor of mother's milk had a positive effect on sucking behavior and milk ingestion of preterm babies, which in turn resulted in a shortened stay in the hospital.

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Iranmanesh et al., 2015, Iran, (9)	Randomized controlled trial	Breast milk smell	Transition time from gavage to oral feeding and hospital stay	46/46	Olfactory stimulation was performed with the gavage procedure, after that, a 1-mL volume of breast milk was poured on the cotton and it was placed near the infant's nasal septum (1.5-2 cm) and was removed after gavage.	No	-	Self-records	Preterm infants exposed to breast milk odor during gavage feeding made a transition to oral feeding sooner and were discharged from the hospital earlier than control group infants.
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