

The Effect of Lavender Oil for Relief Painful Producer in Children and Infants: A Systematic Review

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Abstract

Background

To manage the pain, one of the alternative methods entails the essential oils usage. Aim of this study is to give comprehensive information about the effect of lavender for aliavative painful producer in infants and children.

Materials and Methods: A systematic search was conducted on English databases of Scopus, Medline, Cochrane Library, EMBASE and Web of Science up to the end of February 2019. Authors performed search without any time restrictions. Two authors independently performed search and assessed their quality.

Results: The five studies (n=414 participants) were included. In the first study, the change of NIPS score was significantly lower in lavender than control groups. The duration of crying was 75.47 (60.675), and 105.22 (75.739) seconds in the lavender and the control groups, respectively, which was significantly different. In second study, aromatherapy with lavender was unable to change the VAS score (p=0.40); while heart rate decreased to a significance borderline level (p=0.0639). In the third study, significant differences in the mean SpO₂, respiratory rate, and heart rate at different time points between the aromatherapy with lavender and the control groups in preschool children. In the fourth study, the lavender group exhibited lower NIPS score compared to the amniotic fluid and breast milk groups. In fifth study, 80 term infants were assigned into case (n=40), and control (n=40) groups, there was a significant difference in pain scores between the two groups, lavender and control.

Conclusion

This study showed that the lavender as non-pharmacological effective way is effective to alleviate the blood sampling-related pain in infants and children, though it did not affect the duration of crying.

Key Words: Children, Effects, Lavender, Infants, Pain.

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1- INTRODUCTION

The International Association for the Study of Pain delineated the pain as an afflictive sensory and emotional experience accompanied by the actual or potential tissue damage (1). The traditional general belief bases on the lack of the pain sensation in the premature infants; conversely, today some evidence confirms the pain sensation in the premature infants who are under the surgical procedures (1). The pain sensation appears after the 26th week of gestational age, in accordance with the current studies. Given the studies, the infants experience the agonizing procedures 10 to 16 times per day during their early lives; they can perceive, process, and respond to the painful stimuli. Moreover, the infants' pain threshold is 30 to 50% lower than that in adults. The infant's problematic and persistent unrelieved pain makes the detrimental physiologic infliction overall vital organ systems such as the brain structure. Hence, it has the protracted cumulative and the life-threatening consequences (2).

To avoid these negative outcomes, the pain of the infants is required to be precisely and thoroughly assessed, and the negative effects of the pain be lessened through the effective pain-relieving methods. The effective pain management is the pharmacological and the non-pharmacological methods, however, it is the side reactions which increase the people's interest toward utilizing the alternative and supplementary methods (3). The orally using sucrose or glucose, breast feeding, the non-nutritive sucking, the skin-to-skin contact with the mother, the swathing, facilitated tucking (bending the arms and legs), and the sensory saturating which are namely the sense of touch (massaging), sound, smell, and vision, are known as the non-pharmacological measures (4). To manage the pain, one of the alternative methods entails the essential oils usage (5), a

technique, namely the inhalational aromatherapy, requires utilizing the essential oils for the respiration. The essential oils play a crucial role in lessening the pain, the mental stress, depression, and enhancing the vital signs. The aromatherapy effects can be felt as soon as the aroma molecules are absorbed through the nasal mucosa. Consequently the aroma molecules are transformed to the nervous signals at the olfactory bulb, the amygdala, and the limbic system, and illustrate the therapeutic effects by inducing the various neuro-transmitters release; the enkephalin, the endorphins, and the serotonin, to name but a few (6).

The aromatherapy application in the nursing care has been existed in different fields. The essential oils have been applied in small doses in both the massage and the environmental scents in the nursing literature (7). Lavender (*Lavandula Angustifolia*) is known as one of the essential oils utilized in the aromatherapy; it is a fragrant plant belonging to the Lamiaceae family. Furthermore, it has the anti-bacterial, the anti-fungal, the anti-bloating, muscle relaxant, and analgesic effects. Using the Lavender essential oil in children is risk-free. The antispasmodic, sedative, and anesthetic effects of the lavender essential oil lead to extensive application of the aromatherapy.

The Linalyl acetate and Linalool of lavender essence stimulate the parasympathetic system by decreasing the heart rate, the respiratory rate, and sedative effect of lavender essence. The studies conducted on the non-human samples confirmed that the inhalation of essential oils join in the blood flow and instigate the pharmacologic effects via inducing the outcomes of the endorphins and the norepinephrine. Moreover, as a hypothesis, if the chemical ingredients of the essential oils attach to the receptors of the olfactory bulb, it will affect the limbic system, the brain's emotional center, and influence the

pain sensation as a consequence (8). Aim of this study is to provide comprehensive information about the effect of lavender for relief of painful procedures in infants and children.

2- MATERIALS AND METHODS

2-1. Strategy for the selection of relevant articles

A systematic search was conducted on five English databases of Scopus, Medline (via PubMed), Cochrane Library, EMBASE and ISI Web of Science from inception to February 10, 2019. Authors performed search without any time restrictions. In addition, search was conducted with main keywords of (Aromatherapy OR Olfactory) AND (pain OR venipuncture OR painful producers). Two authors performed search in mentioned databases. Title and abstract of searched articles were studied to find relevant ones, whose full-text was then downloaded and read in detail. At last, the eligible articles were selected in accordance with inclusion criteria, followed by analysis to assess their quality. This process was done independently and in duplication by two reviewers and any disagreement was resolved by the third reviewer.

2-2. Data collection process

We developed a form based on the Cochrane Consumers and Communication Review Group data extraction template and followed it for each study (9). A third reviewer solved two reviewers collected the data, independently collected data was combined and compared for accuracy any discrepancies.

2-3. Eligibility criteria

Participants, interventions, comparators, and outcomes (PICO) was used to formulate the review objective and inclusion criteria.

Participant: Infants and Children up to 18 years old. *Interventions:* Any type of oral appliance as the primary treatment, use of oral appliance in conjunction with other treatment modalities, comparison between different types of oral appliances, comparison between oral appliances and other treatment modalities. *Comparators:* Treatment vs. control group, treatment vs. different type of treatment, before vs. after treatment. *Outcome:* Reduction of painful procedure in children and infants.

2-4. Included studies: Randomized controlled trials (RCT), clinical studies both randomized and nonrandomized either retrospective or prospective. 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 English to February 2019.

2-5. Data items

Data collected from the selected studies included: name of first author, country, year, study design, study population, intervention applied, dropout rate, and main outcomes.

2-6. Quality assessment of included articles

The quality of included articles was assessed by five-item Jadad scale (10), including existence of randomization, method of randomization, existence of blinding, method of blinding, and withdrawals and dropouts. Two authors, independently (**Table.1**), assessed quality assessment of included articles.

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, duration of treatment, duration of follow- up, meta-analysis were not conducted.

Table-1: Quality Assessment using Jadad scale (10).

Author Country, Year, (Reference)	Randomization			Blinding			Report of dropping out	Intention to treat	Baseline comparability
	Mention randomization	Appropriate Method	Inappropriate Method	Mention blinding	Appropriate method	Inappropriate method			
Vaziri, Iran, 2019, (8)									
Razaghi et al., Iran, 2015, (7)									
Bikmoradi et al., Iran, 2017, (6)									
Małachowska et al., Poland, 2016, (5)									
Akcan and Polat, Turkey, 2016, (3)									

: Yes; : No; : Unclear.

3-RESULTS

The five studies (n=414 participants) were included into systematic review (**Table.2**). PRISMA flow diagram was used to show the process of study selection (**Figure.1**). In the first study, Vaziri (8), allocated their study infants into two categories of lavender oil (n=42) and placebo (n=57). The aromatherapy with lavender oil or placebo was started one minute prior to vaccination. Three times were considered to measure the pain intensity with the aid of Neonatal Infant Pain Scale (NIPS), consisting of prior to, 15 seconds and 5 minutes after vaccination. Moreover, the duration of crying of all infants was recorded. The NIPS score was lower significantly after 5 minutes in the lavender group. The repeated measures ANOVA test results revealed the change of NIPS score with time, which was significantly different in the two groups. The duration of crying was 75.47 (60.675), and 105.22 (75.739) seconds in the lavender and the control groups, respectively, which was significantly different. In a studies by

Małachowska et al., the essential oil effects were evaluated on autonomous response to pain sensation within blood glucose self-monitoring on 73 children aged <18 years hospitalized with well-controlled type 1 diabetes. Aromatherapy with lavender was unable to change the Visual Analogue Scale (VAS) score (p=0.40), while heart rate decreased to a significantly borderline level (p=0.06) (5). Bikmoradi et al., reported a single blinded clinical trial on 60 preschool children admitted to the Besat hospital of Hamadan, Iran, in 2015; who were selected by the convenience sampling method allocated into two groups of the aromatherapy group (n=30), which inhaled five drops of 2% Lavender essence and the control group (n=30) that inhaled five drops of placebo (distilled water) for 20 minutes prior to venipuncture. The measurements of desired physiological parameters were carried out 30 minutes prior to, immediately, 5 minutes and 10 minutes after intravenous catheter insertion. Their analysis demonstrated significant differences in the mean Oxygen saturation (SpO₂) (p=0.003), respiratory rate

($p=0.001$), and heart rate ($p=0.001$) at different time points between the aromatherapy and the control groups (6). Akcan and Polat investigated the lavender smell impact on the pain of newborns during heel lance. The newborns smelled the lavender sample for 5 minutes prior to heel lance until 5 minutes afterward, followed by the measurement of the pain intensity by Neonatal Infant Pain Scale (NIPS). Based on the observations, the lavender group exhibited lower NIPS score compared to the amniotic fluid and breast milk groups. They finally stated that the pain during the

invasive intervention could be attenuated in newborns due to the lavender smell (3). In a clinical trial by Razaghi et al., 80 term infants were assigned into case ($n=40$), and control ($n=40$) groups. The case group were exposed to the scent of lavender overnight (8 hours) prior to blood collection, as well as the next day while blood sampling and simultaneously recording the Douleur Aigue Nouveau-ne (DAN) scale. According to Mann-Whitney test analysis, there was a significant difference in pain scores between the two groups ($p=0.001$) (7).

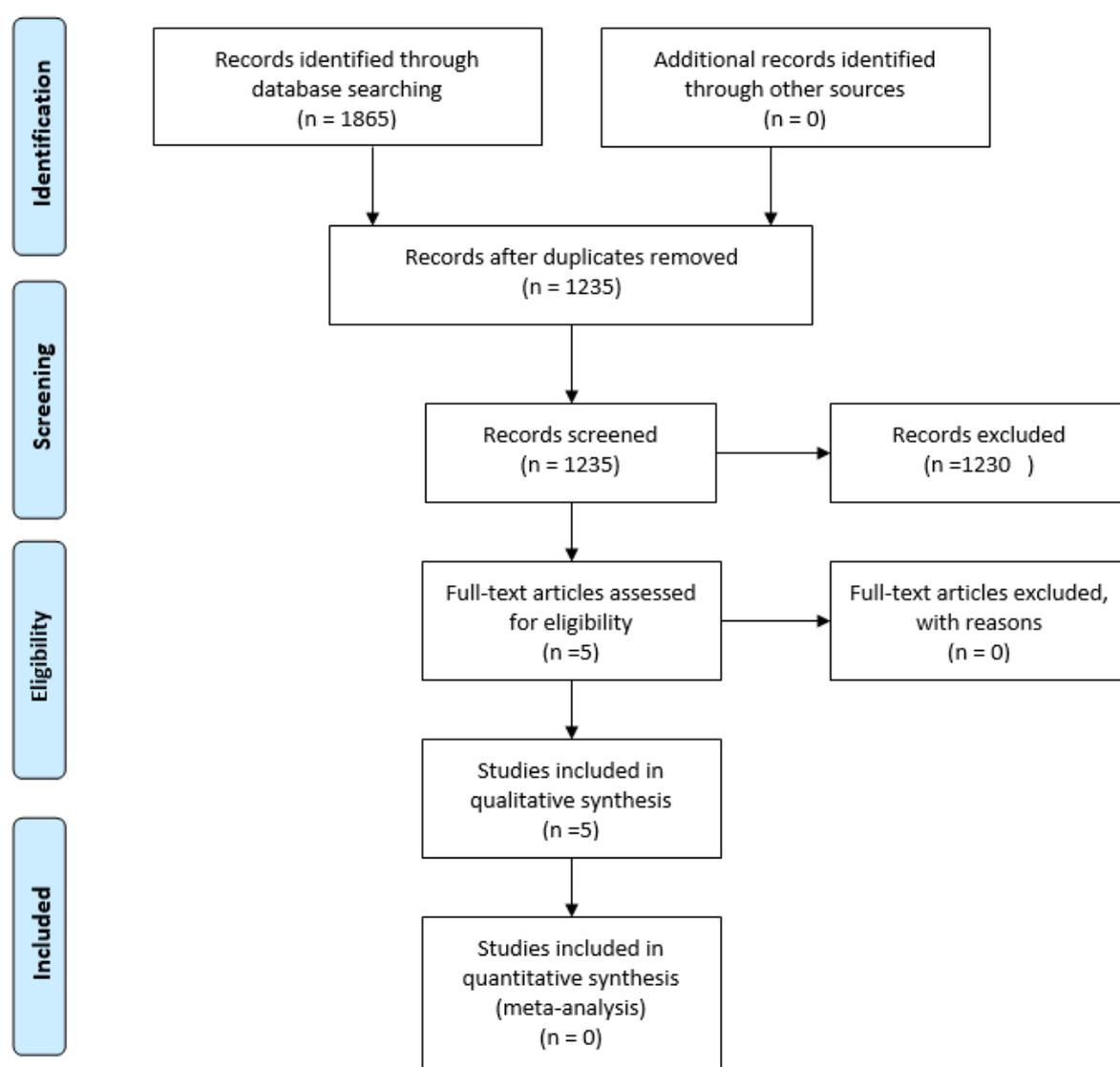


Fig.1: PRISMA flowchart.

Table.2: General characteristics of included studies.

Author, Country, Year, Reference	Duration, week	Age	Drop out	Intervention	Control	Treatment	Control	Main results
Vaziri et al., Iran, 2019, (8)	15 seconds and 5 min after injection	37-42 weeks	0%	42	42	Lavender oil	Placebo	Inhalation of low-dose lavender oil attenuated the pain intensity and elevated soothing in the infants receiving the pentavalent vaccine injection.
Razaghi et al., Iran, 2015, (7)	At night for 8 hours before blood sampling. and the next day, at the time of blood lavender used in seconds of starting cry to silence that lasted at least 5 seconds	Over 37 weeks	0%	40	40	Lavender scent	No scent	There was a significant difference in pain scores between the two groups lavender and control (p=0.001).
Małachowska et al., Poland, 2016, (5)	Four times per day	12.7 years	81/647	157 with orange essential oil; and 178 with the lavender	157 with orange essential oil; and 178 with the lavender	Orange or lavender essential oil	Without any intervention	The aromatherapy had no effect on the perception of pain reported by VAS based on multivariate analysis, but reduced the autonomic response to a painful stimulus by decreasing the heart rate.
Akcan and Polat, Turkey, 2016, (3)		38-42 weeks	33/135	Lavender group, n=27/ in the breast milk group, n=24, in the amniotic fluid group, n=26	Lavender group, n=27/ in the breast milk group, n=24, in the amniotic fluid group, n=26	Lavender, breast milk, and amniotic fluid	5 mL distilled water	The lavender group exhibited lower NIPS score compared to the amniotic fluid and breast milk groups.
Bikmoradi et al. Iran, 2017, (6)	Inhaled 5 drops for 20 min, exactly 30 min before entering the venipuncture room and the pain severity immediately and 5 and 10 min after intravenous catheter insertion	4.6 ± 1.2 years in the aromatherapy group, and 4.4 ± 0.9 years in the control group	12/72	30	30	5 drops of 2% lavender essence distilled in alcohol	5 drops of distilled water as a placebo	Significant differences in the mean SpO ₂ (p=0.003), respiratory rate (p=0.001) and heart rate (p=0.001) at different time points between the aromatherapy and the control groups.

NIPS: Neonatal Infant Pain Scale; VAS: Visual analog scale; SpO₂: Oxygen saturation.

4- DISCUSSION

The purpose of the present research was to evaluate the effects of inhalation aromatherapy using lavender for the alleviation of the pain intensity. In the aromatherapy, the inhalational essence oils might reportedly improve vital signs and attenuate the depression, mental stress and pain. This technique can exert its functions through the nasal mucosa due to the absorption of aroma molecules that are then converted to nervous signals in the olfactory bulb, amygdala, and the limbic system, therefore, subsequently applying therapeutic influences via the release of various neurotransmitters like serotonin, endorphins and enkephalin. The essential oil of lavender, scientifically named *Lavandula angustifolia* from family Lamiaceae, can be applied as an agent in the aromatherapy. This plant has been shown to have some positive properties for human health, such as muscle relaxant, anti-bloating, anti-fungal, anti-bacterial and analgesic activities.

It can be safely used among children to show antispasmodic, sedative, and anesthetic impacts. Its active ingredients of Linalool and Linalyl acetate are able to trigger the parasympathetic system via a decrease in blood pressure, respiratory rate and heart rate, and thus function as narcotic and sedative agent (8). Patrick Wall and Ronald Melzack in 1965 proposed for the first time a physiological explanation for the effect of psychology on the perception of pain. One of the leading theories of pain is "gate control theory" derived from the combination of specificity theory and the peripheral pattern theory, providing a neural basis confirming the specificity and pattern theories and so revolutionized research on pain. Despite reports on the inability of the gate control theory, it remains a pain theory that is capable of accurately explaining the physical and psychological aspects of pain (11, 12).

The samples of aromatherapy group exhibited a significant reduction in the average pain intensity when comparing with the control groups at all three time points. According to a study, the lavender odor relieved the pain effectively, but there was no effect on the duration of crying within the collection of venous blood samples. The lavender it seems, could lessen the signs of pain because of its antifungal, antispasmodic and sedative effects (13). Based on the current and previous results, the lavender odor owing to its sedative property reduces infantile pain and stress during painful injections or blood tests. The aromatherapy of mothers could reportedly provide a safe environment for the newborns and relieve their stress and pain (14, 15).

Some methods related to distraction are available to deal with the stress and the pain. There are reports regarding the odor impacts, as distraction, on painful stages in the newborns. Badiie et al. worked on the influence of breast milk smell compared with formula scent on the pain when punching premature infant's heel and their results revealed that the formula group had significantly higher pain than mother's milk group (4). Gobett et al., found that Vanilla essence attenuated the heel stick puncture-caused pain in preterm infants. Such an outcome occurred only when the infants were exposed to the vanilla prior to testing (16). Sadatosuchini et al. and Gabet et al. found that the aromatherapy with familiar vanilla alleviated the pain in the heel stick puncture of term neonates (16, 17). Nishitan et al. demonstrated that the infants exposed to their own maternal milk showed significantly lower behavioral reactions, saliva cortisol content and pain in comparison with the infants exposed to other maternal breast milk or formula (18). In accordance with the results from a study by Rattaz et al., the neonatal stains were decreased following the maternal milk and vanillin aromatherapy, and just scent of

breast milk was effective in lowering the neonatal stress after blood sampling (19). The results of a study by Bikmoradi et al. aimed to determine the effect of inhalation aromatherapy with lavender essence on vital signs of patients undergoing coronary artery bypass graft showed no statistically significant difference in the respiratory rate after the intervention between the case and the control groups, indicating the importance of some factors such as the type of odor, duration of administration, profile of age group on the study results (20). We could not find any similar study reporting the effect of lavender odor on the pain among the term neonate. Distracting the infants with familiar vanillin aroma within arterial puncture could decrease the duration of crying when comparing with other groups. According to the analysis of physiologic factors, less change was observed in the level of oxygen saturation within the arterial puncture in the familiar aromatic group. The familiar aroma could shorten the duration of crying and decrease the oxygen intake within the arterial puncture (16).

The sedative and palliative activities of linalool, one of the main lavender compounds, on the central nervous system (CNS) may be one of the reasons for the obviously significant the outcomes, thereby decreasing autonomic response to painful triggers. The sweet odor of lavender can cause a distraction regarding pain and a reduction in the perception of pain intensity (20). Pediatric service providers can also use lavender essence to reduce changes in physiological parameters caused by other painful invasive procedures, such as vaccination, venous blood sampling, and intravenous, intramuscular, and subcutaneous injections. In addition, inhalation aromatherapy with lavender essence can be employed as one of the inexpensive, safe and effective complementary medicines for infants and children.

5- CONCLUSION

This systematic review showed that lavender could be used as a non-pharmacological effective way to alleviate the blood sampling-related pain in infants and children, though it did not affect the duration of crying.

6- CONFLICT OF INTEREST: None.

7- REFERENCES

1. Neshat H, Jebreili M, Seyyedrasouli A, Ghojzade M, Hosseini MB, Hamishehkar H. Effects of breast milk and vanilla odors on premature neonate's heart rate and blood oxygen saturation during and after venipuncture. *Pediatrics & Neonatology*. 2016;57(3):225-31.
2. Aghagoli S, Salimi A, Salimi M, Ghazavi Z, Marofi M, Mohammadbeigi A. Aromatherapy with rosa damascenes in apnea, bradycardia and Spo2 of preterm infants; a randomized clinical trial. *International Journal of Pediatrics*. 2016;4(6):1911-8.
3. Akcan E, Polat S. Comparative effect of the smells of amniotic fluid, breast milk, and lavender on newborns' pain during heel lance. *Breastfeeding Medicine*. 2016;11(6):309-14.
4. Badiie Z, Asghari M, Mohammadzadeh M. The calming effect of maternal breast milk odor on premature infants. *Pediatrics & Neonatology*. 2013;54(5):322-5.
5. Małachowska B, Fendler W, Pomykała A, Suwała S, Młynarski W. Essential oils reduce autonomous response to pain sensation during self-monitoring of blood glucose among children with diabetes. *Journal of Pediatric Endocrinology and Metabolism*. 2016;29(1):47-53.
6. Bikmoradi A, Khaleghverdi M, Seddighi I, Moradkhani S, Soltanian A, Cheraghi F. Effect of inhalation aromatherapy with lavender essence on pain associated with intravenous catheter insertion in preschool children: A quasi-experimental study. *Complementary therapies in clinical practice*. 2017;28:85-91.

7. Razaghi N, Sadat Hoseini AS, Aemmi SZ, Mohebbi T, Boskabadi H. The effects of lavender scent on pain of blood sampling in term neonates. *International Journal of Pediatrics*. 2015;3(2.2):535-41.
8. Vaziri F. The Effect of Aromatherapy by Lavender Oil on Infant Vaccination Pain: a Double Blind Randomized Controlled Trial. *Journal of caring sciences*. 2019;8(1):17.
9. Cochrane Consumer and Communication . Available at: <https://cccr.org/cochrane.org/author-resources>.
10. 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? *Controlled clinical trials*. 1996; 17(1):1-12
11. Moayedi M, Davis KD. Theories of pain: from specificity to gate control. *Journal of neurophysiology*. 2012;109(1):5-12.
12. Campbell TS, Johnson JA, Zernicke KA. Gate control theory of pain. *Encyclopedia of Behavioral Medicine*. 2013:832-4.
13. Çetinkaya B, Başbakkal Z. The effectiveness of aromatherapy massage using lavender oil as a treatment for infantile colic. *International journal of nursing practice*. 2012;18(2):164-9.
14. Jebreili M, Neshat H, Seyyedrasouli A, Ghojazade M, Hosseini MB, Hamishehkar H. Comparison of breastmilk odor and vanilla odor on mitigating premature infants' response to pain during and after venipuncture. *Breastfeeding Medicine*. 2015;10(7):362-5.
15. Sullivan RM, Toubas P. Clinical usefulness of maternal odor in newborns: soothing and feeding preparatory responses. *Neonatology*. 1998;74(6):402-8.
16. Goubet N, Strasbaugh K, Chesney J. Familiarity breeds content? Soothing effect of a familiar odor on full-term newborns. *Journal of Developmental & Behavioral Pediatrics*. 2007;28(3):189-94.
17. Sadathosseini AS, Negarandeh R, Movahedi Z. The effect of a familiar scent on the behavioral and physiological pain responses in neonates. *Pain Management Nursing*. 2013;14(4):e196-e203.
18. 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. *Neuroscience Research*. 2009;63(1):66-71.
19. Rattaz C, Goubet N, Bullinger A. The calming effect of a familiar odor on full-term newborns. *Journal of Developmental & Behavioral Pediatrics*. 2005;26(2):86-92.
20. Bikmoradi A, Seifi Z, Poorolajal J, Araghchian M, Safiaryan R, Oshvandi K. Effect of inhalation aromatherapy with lavender essential oil on stress and vital signs in patients undergoing coronary artery bypass surgery: A single-blinded randomized clinical trial. *Complementary therapies in medicine*. 2015;23(3):331-8.