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The Effect of Aromatherapy on Anxiety in Mothers with Premature Infants: A Clinical Trial Study

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Abstract

Background: Mothers of premature infants admitted to the neonatal intensive care unit (NICU) experience stress and anxiety. Reducing anxiety in mothers is essential to ensure the quality of care for infants with special needs after discharge. Non-pharmacological methods of managing anxiety are encouraged for breastfeeding mothers.

Aim: This study aimed to determine the effectiveness of aromatherapy with Damask Rose (DR) on anxiety in mothers with premature infants admitted to NICU.

Method: In this clinical trial study, 75 eligible mothers selected through convenience sampling method were randomly assigned into intervention and control groups. In addition to the routine care, the mothers in the intervention group received a 5-10-minutes inhaled aromatherapy with 10% DR for ten consecutive nights. The mothers of the control group only received routine care. The tools of the study were a demographic information form and the State-Trait Anxiety Inventory (STAI). Data were analyzed using SPSS statistical software (version 22). $P<0.05$ was considered statistically significant.

Results: The mean scores of state anxiety significantly reduced in the intervention (48.88±10.16 to 40.68±8.62) and control groups (52.30±7.40 to 51.27±7.30). Due to the significant difference between change in before-after scores in the two groups, aromatherapy was more effective than routine care in reducing anxiety ($P<0.0001$). Also, the mean score of trait anxiety significantly decreased from 49.14±9.99 to 44.37±10.0 in the intervention group ($P<0.0001$).

Implications for Practice: Aromatherapy with DR decreases anxiety in mothers of preterm infants hospitalized in the NICU; therefore, it can be recommended for the management of anxiety in this population.

Keywords: Aromatherapy, Anxiety, Damask rose, Mothers, Neonatal intensive care unit, Premature infants

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Introduction

Preterm birth is defined as birth before the 37th week of pregnancy. The number of surviving premature infants is increasing due to medical and technological advances (1, 2). However, premature infants need special care because of common health problems caused by prematurity, such as respiratory distress syndrome (3). This group of vulnerable infants constitutes a large population of cases admitted to neonatal intensive care units (NICU) (4). NICU admission is highly stressful for parents. The critical situation and uncertainty about the health of the preterm infant admitted to the NICU causes stress-related symptoms such as grief, guilt, anger, loss of self-esteem, feelings of failure, and anxiety for the mothers (4, 5).

High level of anxiety leads to physiological and psychological symptoms and changes in mental functions (6, 7). Anxiety is defined as the feelings of tension, worried thoughts, and physical symptoms such as pervasive muscle contractions and increased heart rate. Anxiety is not directly caused by stressors but by incompatibility with the stressors (4, 8). Mothers of infants admitted to the NICU are more prone to anxiety symptoms due to postpartum physical and psychological status. In addition, concerns and uncertainty about the infant's health are other related factors of maternal anxiety (8, 9). In the study conducted by Kazemi and colleagues, 54.5% of Iranian mothers considered stress and anxiety as the biggest barrier to interact with their infants in NICU (3). Moreover, González-Hernández et al. reported that 34% of Mexican mothers with neonates in the NICU had anxiety (10). Another study in the Gaza Strip showed that50% of mothers with premature infants admitted to the NICU experienced severe anxiety (11). Maternal anxiety directly affects ability to play a parenting role. However, due to their special needs, preterm infants need an empowered and capable caregiver who has ability to continue caring for them after discharge at home (3, 6). Mothers with anxiety experience less self-efficacy, self-esteem, and adequacy in parenting roles than other mothers, and these factors directly affect their infant's health (12, 13).

The prevalence of poor psychological adjustment among the mothers with preterm infants hospitalized in NICU highlights the crucial role of nurses. NICU nurses are responsible for identifying anxiety in mothers and providing efficient and effective interventions to manage it. Since the use of pharmacological methods for reducing anxiety in postpartum period is limited due to breastfeeding, several studies have sought to evaluate the effectiveness of non-pharmacological approaches to reduce anxiety in mothers (14).

Aromatherapy is one of the non-pharmacological methods which is considered as the alternative and complementary method. The effectiveness of aromatherapy has been investigated on some variables in different populations (15). Aromatherapy uses essential oils (concentrated oils extracted through steam distillation) to treat and prevent health problems (16). The essential oils selected for this purpose have very little toxicity, and if be used by trained and qualified therapists, are a safe option compared with conventional modern medications (17). One of these oils is Damask rose (DR) essential oil, from the rose family or Rosacea, with the scientific names of Rosa Damascenes Mill (17). Various studies have shown the positive effects of aromatherapy on several variables, such as postpartum depression (18, 19) and anxiety (17, 18). To the best of our knowledge, there is no study to show the impact of aromatherapy on the anxiety of mothers with preterm infants admitted to the NICU. Therefore, this study was performed aimed to assess the impact of aromatherapy on anxiety of mothers with hospitalized infants in the NICU.

Methods

This study was a clinical trial study conducted in 2021 on 75 mothers of premature infants admitted to the NICU in Mahdiyeh Hospital, Tehran. The sample size was calculated based on the mean and standard deviation (SD) scores selected from the literature (20), at confidence level of .0.95, test power of 80%, and the observed effect size of 0.65 using the formula (21).

The minimum sample size was estimated as 37 participants for each group. Considering the possibility of 10% loss, 40 participants were determined for each group (figure 1). The inclusion criteria were age of 18-35 years (not being in the group of high-risk pregnant mothers in terms of age), having an infant with gestational age of less than 37 weeks, and at least 48 hours have passed since the infant was admitted to the NICU, a good sense of smell, willingness to participate in the study, not being treated for anxiety and other psychological problems, no history of allergy to

DamasK rose, no use of aromatherapy by mother to treat her anxiety.
The exclusion criteria were: leave the study at any time; discharge or death of the infant, change in the health situation of infant which causes a new stressor for mother during the intervention, occurrence of the signs and symptoms that may result from the intervention needing medical intervention (headache, allergy signs, nasal dryness or bleeding).
Data was collected using a demographic questionnaire and the Persian version of the State-Trait Anxiety Inventory-form (STAI). The demographic questionnaire included age, level of education, occupation, type of recent delivery, number of pregnancy and number of children of the mother, and infant's gestational age at birth, gender, and the reason for NICU admission and its duration until the time of the study.
The STAI was developed by Spielberger (1970) to measure state (anxiety about an event) and trait (anxiety level as a characteristic) anxiety. It consists of self-report 40 questions based on a 4-point Likert scale. Each trait and state anxiety scores range from 20 to 80. A higher score shows a higher level of anxiety. The 4-point scale for state anxiety is as follows: 1) not at all, 2) somewhat, 3) moderate, 4) very much; and for trait anxiety is as follows: 1) seldom, 2) sometimes, 3) often, 4) almost always. A score below 34 indicates minimum or no anxiety. Scores between 35 to 45, 46 to 56, and 57 or more indicate mild, moderate, and severe anxiety, respectively (22, 23).
The STAI has been used in many studies, and its psychometric properties were evaluated in different populations and languages (22, 24-26). The translated versions of STAI have showed acceptable reliability and validity (27). The STAI was translated into Persian and validated in 1993, showing an internal consistency of 0.94 (27). Several studies used the Persian version of STAI in various Iranian populations (28, 29). In the study of Abdoli and colleagues on Iranian high school students, the Cronbach's alpha of the Persian version of STAI was reported 0.886 for trait and 0.846 for state anxiety (28).
The intervention was conducted by the first author of the study. To avoid contact between the participants of the two groups, using the lottery, one of the groups (the intervention group) was randomly identified for the first sampling round. After two weeks (to ensure the discharge of all participants), sampling was performed for the control group. After the discharge of the last person in this group, sampling was repeated for the intervention group. The process continued until the number of participants reached the desired size in both groups. The control group received routine recommendations for reducing anxiety, such as avoiding coffee, adequate sleep, and positive thinking.
After explaining the objectives and procedure of the study, the mothers signed an informed written consent form. The mothers in the intervention group received a package containing an anti-light vial filled with a dropper with three milliliters (120 drops) of Damask rose 10% essence, a glass dropper, enough cotton balls, and a guide leaflet. Also, the researcher provided verbal guidance consistent with the written guideline of how to teach the participants for aromatherapy. They were asked to pour three drops of the essence on one of the cottons and inhaled it for 5-10 minutes from a distance of less than ten cm. They should performe it 20 minutes before going to bed and continue for ten nights in a row. The researcher gave a phone number to all mothers of both groups (control and intervention groups) for counseling regarding the management of stress and anxiety symptoms.

Preparation of the Damask rose essential oil

The specialized laboratory of the Research Institute of Plants and Medicinal Raw Materials of SBMU prepared the Damask rose essence used for this study. Gas Chromatography-Mass Spectroscopy (GC-MS) was used to analyze the extracted oil as a part of the quality and safety control of the product. The analysis revealed 28 compounds in the rose oil. The concentration rate of Citronellol, Geraniol, and alpha-Pinene was 50.15%, 25.41%, and 0.06%, respectively (Figure 2). Table 1, also presented the results of microbial analysis of the product.
Data were analyzed using SPSS software (version 22.0, SPSS Inc, Chicago, Il, United States). Independent and paired t-tests were used to compare the intragroup and intergroup anxiety before and after the intervention. $P< 0.05$ was considered statistically significant.

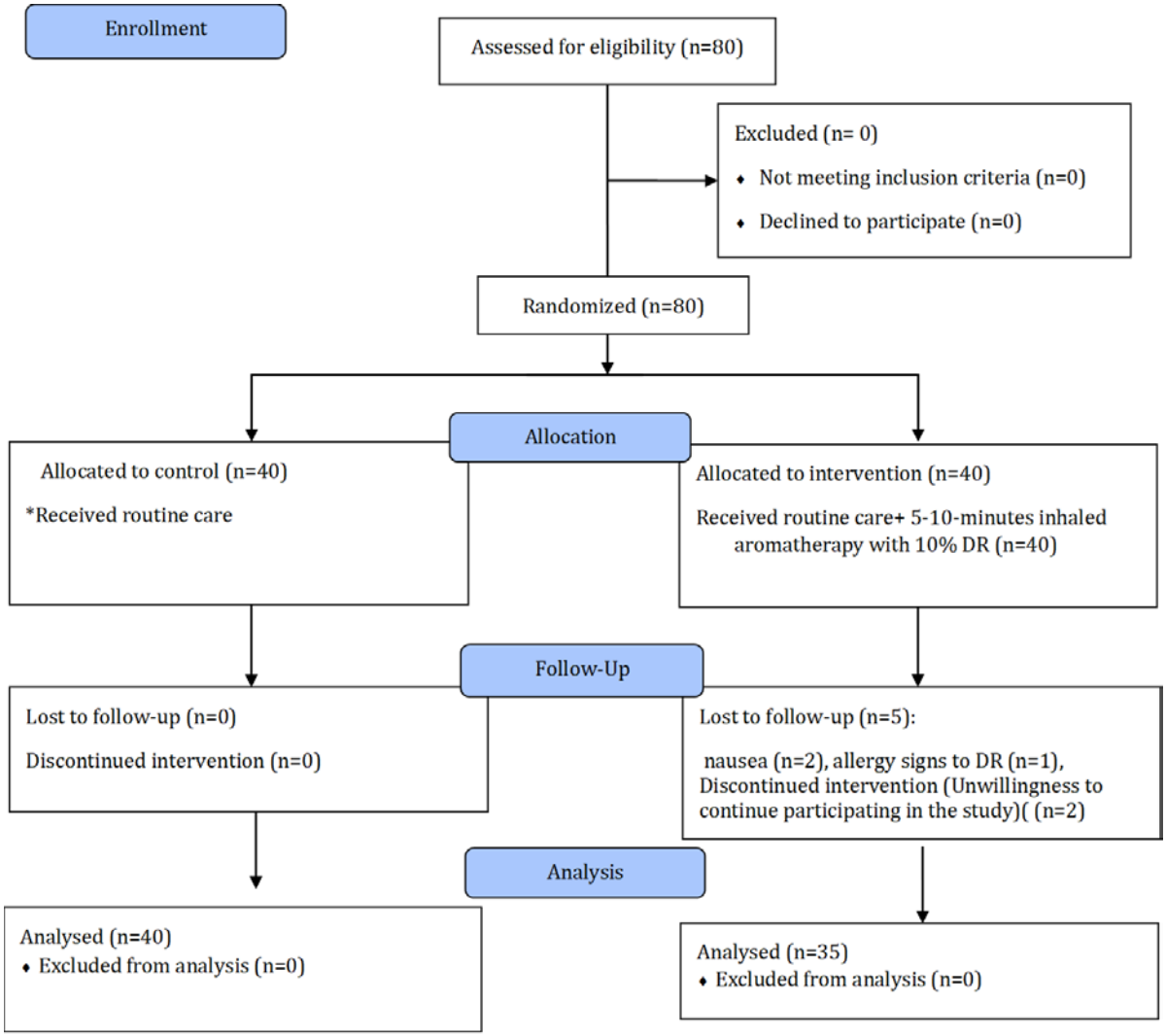

Figure 1. Clinical trial flowchar

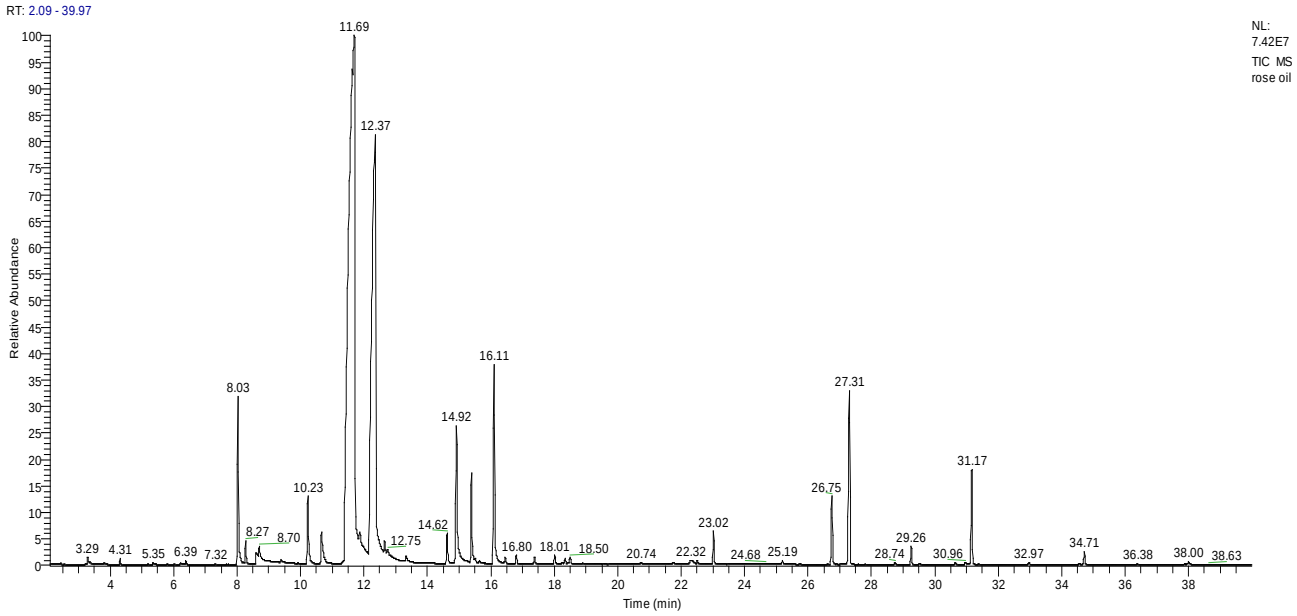

Figure 2. GC-MS chromatogram of Rose oil

Table 1. Microbial analysis of damask rose essential oil used in this study

Microorganisms	Results (CFU/g)	Acceptable criterion (United States pharmacopeia)
TYMC*	<10	10^1CFU/ML
TAMC**	<10	10^2CFU/ML
Staphylococcus aureus	Absence	Absence
Pseudomonas aeruginosa	Absence	Absence

*Total *combined yeasts/molds count* (*TYMC*)
**Total aerobic microbial count (TAMC)

Results

Of 80 recruited mothers, five were excluded due to nausea, allergy-like symptoms after inhalation such as itching, unwillingness to continue the intervention, and not answering the phone to gather information after the intervention. All the excluded participants were in the intervention group. The data of 75 mothers (35 in the intervention and 40 in the control groups) was analyzed. The mean age of mothers in the intervention and control groups were 29.63±49.53 and 30.70±61.78 years, respectively. Most mothers (49.3%) had high school education. In total, 80.0% of mothers had 1 (40.0%) or 2 (40.0%) children. Most infants (65.7%) were female and delivered by cesarean section (60.0%). The mean gestational age at birth was 33.31±21.5 in the intervention group and 32.85±26.4 weeks in the control group. In addition, the results of the Chi-square test and independent t-test showed no significant difference between the two groups based on demographics characteristics. Table 2 presented the descriptive statistics of the participants. Kolmogorov-Smirnov test showed the normal distribution of trait anxiety and state anxiety; therefore, parametric tests were used in this study.

Table 3 indicated the mean scores of pre-and-post assessment of participants' state and trait anxiety. Based on the independent t-test results before the intervention, the two groups were not significantly different in terms of mean scores of state anxiety. After the intervention, the mean score of state anxiety significantly decreased from 48.88±10.16 to 40.68±8.62 in the intervention group ($p<0.0001$). It also significantly decreased from 52.30±7.40 to 51.27±7.30 in the control group ($p<0.05$). Moreover, the mean changes in state anxiety in the intervention and control groups was determined as 8.20±3.77 and 10.20±1.65, respectively, and this difference between the two groups was significant ($p<0.0001$).

The mean scores of trait anxiety in the intervention and control groups before the intervention were 49.14±9.99 and 53.17±6.00 ($p=.013$), respectively, which reduced to 44.37±10.0 and 53.87±5.92 after the intervention, and the decrease was only significant in the invention group ($p< 0.0001$). Furthermore, the mean changes in trait anxiety in the intervention and control group was 2.22±2.97 and 0.07±1.30, respectively, and the reduction was only significant in the intervention group ($p<0.0001$).

Table 2. Descriptive statistics (frequency & percentile) of demographic characteristics of participants in the two groups

Variable		Intervention	Comparison	p-value
Level of mother's education	Under high school	7(20.0%)	10(25.0%)	0.512*
	High school diploma	16 (45.7%)	21(52.5%)	
	Bachelor of science degree and more	12(34.2%)	9(22.5%)	
Occupation	Unemployed	28(37.3%)	35(46.7%)	0.281*
	Employed	7(62.7%0	5(53.3%)	
Infant's gender	Male	12 (34.3)	17 (42.5)	0.462*
	Female	23 (65.7)	23 (57.5)	
Type of childbirth	Normal vaginal delivery (NVD)	14 (40.0)	6 (15.0)	0.150*
	Cesarean section (CS)	21 (60.0)	34 (85.0)	

*Chi-square test

Table 3. Mean score of the state and trait anxiety before and after the intervention

		Before the intervention	After the intervention	Mean differences	Paired t-test
State anxiety score	Intervention group	48.88±10.16	40.68±8.62	8.20±3.77	0.001*
	Control group	52.30±7.40	51.27±730	10.2±1.65	0.001*
	Independent T-test	0.108**	0.001**	0.001**	
Trait anxiety score	Intervention group	49.14±9.99	44.37±10.0	2.22± 2.97	0.001*
	Control group	53.17±6.00	53.87±5.92	0.07±1.30	0.922*
	Independent T-test	0.013**	0.001**	0.001**	

*Paired t-test, **independent t-test

Discussion

The results showed that aromatherapy with Damask rose 10% reduces state and trait anxiety in mothers with premature infants admitted to the NICU. Accordingly, the mean scores of state anxiety in both groups significantly decreased; however, the significant difference between changes of the mean scores of the two groups supported the efficacy of aromatherapy on state anxiety. Also, the mean scores of trait anxiety significantly decreased in the aromatherapy group compared with the control group. The change in the mean scores of trait anxiety was not significant in the control group.

In this regard, the findings of this study were in line with the results reported in several studies conducted on various populations. Aromatherapy has been effective in reducing anxiety levels in nulliparous women (30), in hemodialysis patients (31, 32), in patients undergoing coronary angiography (33), in patients undergoing endoscopy (34), in postoperative patients (35), in women following C—section(36), and in women with PMS symptoms (37). Notably, in these studies, different protocols have been reported in terms of dose, duration, or how to use aromatherapy with DR. Accordingly, doses of 1% (30), 2% (32), 10% (38), 25% (31), and 40% (33) of DR extract have been used in the mentioned studies. Also, anxiety was measured using different tools such as the STAI (31, 34, 35), Depression, Anxiety, Stress Scale (DASS-21) (32, 33), visual analogous scale anxiety (VASA) (39), and physiologic parameters (33). The duration of inhalation of the extract in the studies was reported to be ten minutes (30), two minutes (40), and three minutes (41). The duration of aromatherapy was four weeks (31), three weeks (42), and two weeks (43). The aromatherapy method has been inhaled (34, 44), through ultrasonic nebulizer and oral (45, 46). It seems that the used dosage was relevant to the used protocol.

Also, some studies investigated the impact of combination of two essential oils on anxiety or compared two different oils in reducing anxiety tension-related signs (36, 38). The results of these two studies did not show any difference between the two essential oils of lavender and DR in reducing anxiety levels. Recently, a study reported improved quality of life and reduced anxiety levels in the personnel of operating room during the COVID-19 pandemic after receiving aromatherapy with DR, ten minutes before their morning shift for ten days (47).

Several studies have shown that the ethanol component of DR affects the autonomic nervous system, reduces adrenaline and the activity of the sympathetic nervous system, which leads to physical and mental relaxation (48-50). The two main constituents of this plant are geranial and citronellal, which reduce stress and anxiety by affecting dopamine and serotonin receptors (51, 52). Aromatherapy stimulates the limbic and hypothalamic pathways, which reduces corticotrophin release (53). Literature search did not find any study investigating the effect of geranial and citronellal on anxiety. However, a study in depressed mice showed that DR essential oil reduced oxidative stress in depressed mice by increasing antioxidants and decreasing lipid peroxidase. This effect stimulates the limbic system by inhaled molecules and direct effect on memory and related feelings of modulation that reduce the severity of anxiety (54).

The results of the current study were not in line with the results of several mentioned studies. In the systematic review of seven articles, Koohpayeh and colleagues concluded that aromatherapy with DR improves some Pre-Menstrual Syndrome (PMS) symptoms; but was ineffective on PMS-related anxiety (55). In the study of Zare et al., aromatherapy with DR significantly decreased systolic and diastolic pressures; but the anxiety of patients hospitalized in the intensive care unit (ICU) did not change (56). In the study of Najafi and colleagues on patients' candidates for abdominal surgery,

aromatherapy with DR was effective on the scores of state and total anxiety; however, the trait anxiety scores were not significantly different after the intervention (54). Fazlollahpour et al. examined aromatherapy with DR on the anxiety of patients undergoing coronary artery bypass graft surgery; only the scores of state anxiety significantly decreased (57).

One of the limitations of this study was the non-random assignment of individuals to the two groups due to the limitations of hospitalization during the COVID-19 pandemic. It is suggested that future studies be performed by random assignment of the participants. In the conducted studies on the impact of aromatherapy with DR on anxiety, there is a considerable variety in the administration of aromatherapy, including the time and duration, concentration of the essence, and method of administration. It is necessary to conduct studies with the same protocols in performing aromatherapy. The strength point of the present study is that the intervention was nonoral, which is especially important in nursing mothers because the medication does not transmit the infant through milk.

Implications for practice

The results of the present study indicated that aromatherapy is a cost-effective, safe, accessible, and effective way to reduce the symptoms of overt anxiety in mothers with premature infants admitted to the neonatal intensive care unit. Given the responsibility of nurses for maternal health, this method can be considered to manage anxiety and promote mental health in this population.

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Conflicts of interest

The authors declared no conflict of interest.

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