

ORIGINAL RESEARCH

Effects of Aromatherapy on Pain, Stress, and Behaviors of Newborns: A Randomized Controlled Trial

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ABSTRACT

Objective • This study was conducted as a randomized controlled double-blind trial to examine the effects of massage and bathing using lavender oil on the pain, stress, and behavior of newborns. It was hypothesized that the interventions would be associated with changes in pain, stress, and behavior in newborns.

Methods • The sample of the study included 45 term newborns (15 lavender massage groups, 15 lavender bath groups, 15 control groups). Newborns with a postnatal age of 1-5 days and a gestational age of 38-42 weeks, who could tolerate enteral nutrients, were not connected to a respiratory support device, had no skin disease, had no genetic or chromosomal abnormalities, did not undergo surgical intervention, and at least one parent giving written consent were included in the study. Descriptive statistics, chi-square, repeated measures ANOVA, and one-way ANOVA tests were used to evaluate the data.

Results • It was determined that the Neonatal Pain and Stress Rating Scale scores of the newborns in the lavender massage group decreased at the 5th minute after the study compared to before the study. It was determined that the Anderson Behavior Status Scoring System scores of the newborns in the lavender massage group decreased at the 5th minute after the study compared to before the study. It was also determined that the mean difference between the Neonatal Pain and Stress Rating Scale scores of the newborns in the lavender massage group was higher than the other groups.

Conclusion • Aromatherapy massage with lavender oil is more effective in reducing pain and stress levels and improving behavioral outcomes in newborns than a bath application using lavender oil. (*Altern Ther Health Med.* 2024;30(12):43-47).

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INTRODUCTION

Newborns receiving treatment and care in Neonatal Intensive Care Units (NICUs) need to cope with stressors such as numerous environmental stimuli (bright light, loud noise, frequent touch, etc.) and repetitive painful interventions when they are not ready in developmental terms.¹ The care environment that lacks parental contact and stimuli, disturbs the newborn. Facing stress and excessive stimuli negatively

affects the delicate physical condition and immature organ systems of the newborn, and physiological and behavioral stress symptoms can be observed.² Many undesirable stimuli such as excessive noise, light, and intense activity in the unit, as well as situations where sensory stimuli such as monotonous sounds from some medical equipment are common; and inactivity and silence are rare in neonatal units. Sensory deprivation or sensory overload problems might develop in these cases due to decreased quality and/or increased quantity of sensory stimuli.³ These problems negatively affect the adaptation of newborns to the outside world regarding their general physiological parameters and current health status.⁴ Complementary care practices such as aromatherapy can be used to reduce these negative effects in newborns.

Aromatherapy is a complementary care practice that involves the application of essential oils from flowers, plants, and trees to promote health and well-being. Essential oils can be applied by touch and inhalation. The purpose of aromatherapy by touching (massage) leverages the advantage of essential oils such as anti-inflammatory, antispasmodic, antiviral, antifungal, and antibacterial effects, allowing the

muscles to go into resting tonus.^{5,6} Since the senses of touch and smell develop in newborn babies at birth, using aromatic oils with the senses of touch and smell can help to reduce the stress experienced by the baby in the first few days of life.^{7,8}

The most studied fragrance is lavender among the essential oils used in aromatherapy. Lavender generally has antiseptic, anti-inflammatory, pain-relieving, relaxing, and sleep-promoting effects.^{6,9,10} It was reported in previous studies that aromatherapy using lavender oil increases the sleep duration of newborns and infants, and reduces sleep disorders, cortisol levels, colic symptoms, pain caused by invasive interventions, and pain during vaccine injection.¹¹⁻¹⁹ Although studies in the literature report that massage and bathing using lavender oil are effective, to our knowledge, none were conducted to evaluate the superiority of these two methods. The present study investigates the effects of massage and bathing using lavender oil on pain, stress, and behaviors of newborns.

Study Hypotheses

H₁: Applying lavender oil massage on newborns affects their pain, stress, and behavior.

H₂: Providing lavender oil baths to newborns affects their pain, stress, and behavior.

H₃: There is a difference between the effectiveness of massage and bath using lavender oil in newborns in reducing the pain and stress level of the newborn and regulating their behaviors.

METHODS

Study Design and Participants

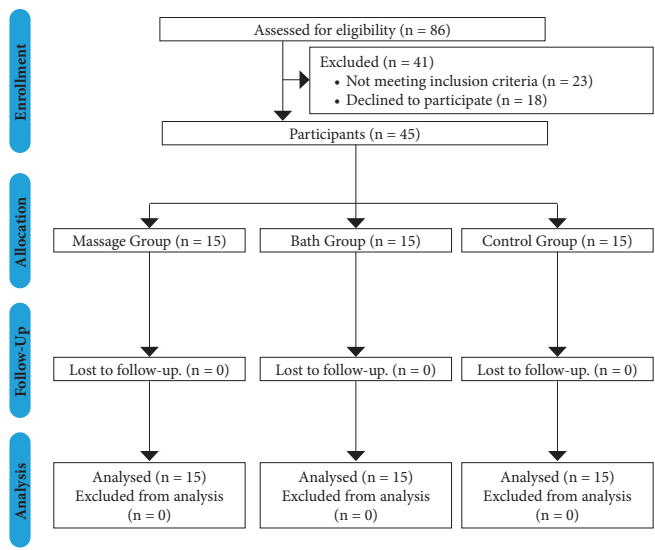
The study had a randomized controlled double-blind experimental design. It was conducted to examine the effects of massage and bathing of newborns using lavender oil on their pain, stress, and behaviors. This clinical trial has been registered at www.clinicaltrials.gov with ID number NCT05770999.

Newborns with a postnatal age of 1-5 days and a gestational age of 38-42 weeks, who could tolerate enteral nutrients, were not connected to a respiratory support device, had no skin disease, had no genetic or chromosomal abnormalities, did not undergo surgical intervention, and at least one parent giving written consent were included in the study (Figure 1). The stratification and lottery methods were used to assign newborns to the groups. The newborns that met the sample selection criteria were stratified according to gestational age, gender, and postnatal age, and were divided into groups by a different researcher other than the researchers involved in this study, by drawing lots, with an equal number of newborns in each group. Before the study commenced, newborns hospitalized in the NICU received no treatment other than their clinical routines (feeding, medical treatment, skincare, and general body care three times a day).

Study Setting and Intervention

The study sample was determined as 45 term newborns (15 lavender massage group, 15 lavender bath group, 15

Figure 1. CONSORT Diagram of the Study (Reproduced from: <http://www.consort-statement.org/consort-statement/flow-diagram/>)



control group) based on the sampling calculation using the G*Power Package Program (3.1.9.7) (Heinrich-Heine-Universität, Düsseldorf) ($1-\beta = 0.95$, $\alpha = 0.05$).¹⁷ In the post-power analysis performed according to the pain and stress values of the newborns, it was found to be $1-\beta = 0.98$ ($\alpha = 0.05$, $d = 0.21$).

Data were collected using the neonatal descriptive characteristics form, the Neonatal Pain and Stress Rating Scale (ALPS-Neo), and the Anderson Behavioral Status Scoring System (ABSS).

Neonatal Descriptive Characteristics Form. This form consists of 6 questions about the descriptive characteristics (gender, postnatal age, gestational age at birth, body weight at birth, body weight during study, and type of birth) of the newborn (Table 1). The form was designed by the researchers.

Neonatal Pain and Stress Rating Scale (ALPS-Neo). The scale was developed by Lundqvist et al. (2014)²⁰ to evaluate pain and stress in preterm and term newborns and was adapted into Turkish by Serap Ceylan and Bolışık (2017)²¹ as a 3-point Likert type scale consisting of 5 items (newborn's facial expression, breathing pattern, tonus of the extremities, hand and foot activities, and activity levels). The measurements are made by observation. As the score obtained increases, stress and pain levels also increase. The Cronbach's Alpha Coefficient of the scale was reported to be 0.70-0.81. In this study, Cronbach's Alpha Coefficient of the scale was determined to be 0.91. Also, the inter-expert intra-class correlation coefficient of the scale was found to be 0.86, 0.95, and 0.82 in the pre-study period, at the 1st, and 5th minutes after the study, respectively.

Anderson Behavior Status Scoring System (ABSS). In ABSS, which is a behavior scoring system that evaluates infant behaviors, newborns' behaviors are divided into 4 categories (eyes closed, eyes half-opening, eyes open, or eyes closed) and are scored in 12 subcategories (1 = regular quiet

sleep, 2 = irregular sleep, 3 = active sleep, 4 = very active sleep, 5 = sleepy, 6 = immobile, 7 = silently awake, 8 = actively awake, 9 = very actively awake, 10 = restless, 11 = crying, and 12 = crying a lot.²² In the present study, the inter-expert intra-class correlation coefficient was found to be 0.87, 0.89, and 0.75 for the pre-study period, at the 1st, and 5th minute after the study, respectively.

Gender, gestational age, and postnatal age were considered as the matching criteria for the newborns that were included in the Lavender Massage, Lavender Bath, and Control Groups. The newborns were recorded with a 10-minute (20 minutes total) video camera before and after the study for ALPS-Neo and ABSS evaluations. Video recordings were evaluated blindly by two independent nurses who specialized in Child Health and Disease Nursing. Both experts reviewed and scored all recordings. To perform the evaluations objectively, the information about the group and characteristics of the newborn was not shared with the experts. The average of the ALPS-Neo and ABSS score evaluations made by both experts was taken and these averages were used in the statistical analysis of the study.

Lavender Oil Preparation Procedure. *Lavandula angustifolia* (Uğurluoğlu Herbal Oil, Türkiye) essential oil, which is recommended for newborns, was used in massage applications. It is recommended to dilute lavender oil with sweet almond oil or jojoba oil. The dilution rate is stated as 1 drop of lavender oil per 20 cc in newborns.²² The lavender oil was diluted with sweet almond oil (Uğurluoğlu Herbal Oil, Türkiye) in the present study.

Intervention

The massage applied to newborns includes passive movements including gentle rubbing movements of the abdomen, back, and shoulders, and kinesthetic stimulation of the arms and legs.¹⁵ Approximately one hour after the newborns were fed, they were not awakened, and recorded for 10 minutes pre-study. After the recording was taken, the newborns were awakened and the massage application was performed for 10 minutes, followed by 10 minutes of post-study recording.

In the bath application, a bathtub bath was prepared by adding diluted lavender oil (1 drop of lavender oil per 20 cc water) to the bath water.²³ One hour after the newborn was fed, 10 minutes of recording was taken for pre-study without waking up. After the recording, the newborn was given a lavender bath for 10 minutes. After the bath, the baby was dressed and placed in the incubator prepared in advance. After being placed in the incubator, a 10-minute post-study recording was taken. In the bathing application for newborns, the newborns were placed in a specially prepared tub with bath water at 35-37°C, and lavender oil was added. Then, the newborn's face and hair were washed first, and then the baby's body was washed from top to bottom with the help of a cloth or sponge.

The newborns in the control group did not receive any treatment other than their clinical routines (vital signs

follow-up, eye and mouth care, changing diapers, changing bed linen, feeding, and medical treatments). The pre-study video recording of the neonates in the control group was taken one hour after feeding for 10 minutes. The post-study recording was taken 10 minutes after waiting for 10 minutes.

Massage and bath applications were applied by two nurses who specialized in pediatric nursing. Both experts were trained by the researcher (TG) who has a certificate in traditional and complementary medicine practices.

Ethical Approval

Before starting the study, necessary permissions were obtained from the Clinical Research Ethics Committee (Decision No: 2021/04-02) and the hospital. Necessary information was given to the parents of the newborns included in the study about the purpose and method of application of the study, and written consent was obtained by providing necessary explanations such as the collected information would be kept confidential and not used anywhere else. The ethical guidelines of the Declaration of Helsinki were complied with in all stages of the study.

Statistical Analysis

The data obtained from the study were evaluated by using the IBM SPSS Statistics Version 22.0 (Chicago, Illinois, USA) statistical package program in a computer medium. Descriptive statistics are given as the number of units (n), percentages (%), arithmetic mean (\bar{x}), Standard Deviation (SD), and median, minimum, and maximum values. The normal distribution of the data of the numerical variables was evaluated with the Shapiro-Wilk Test of Normality and Q-Q Graphs. The Intra-Class Correlation Coefficient (ICC) Analysis was used for the internal consistency analysis among the experts who examined the video camera shootings of the newborns included in the study. The Chi-Square Test was used to compare the categorical variables of the groups, the Repeated Measures ANOVA Test was used to compare the ALPS-Neo and ABSS averages, and the One-Way ANOVA Test was used to compare the difference averages of the groups. A P -value of $< .05$ was considered as statistically significant.

RESULTS

The study was completed with a total of 45 term newborns. No significant differences were detected between the Lavender Massage, Lavender Bath, and Control Groups in terms of gender, gestational age at birth, postnatal age, body weight at the time of the study, body weight at birth, and type of delivery ($P > .05$) (Table 1).

It was found that term newborns in the Lavender Massage Group had decreased ALPS-Neo scores at the 1st and 5th minutes after the study, and a statistically significant difference was detected between the pre-study and post-study 5th-minute scores ($F = 13.000, P \leq .001$). It was found that term newborns in the Lavender Bath and Control Groups also had decreased ALPS-Neo scores at the 1st and 5th minutes after the study,

Table 1. Comparison of Descriptive Characteristics of Term Newborn Babies (n = 45)

Descriptive Characteristics	Massage Group		Bath Group		Control Group		χ^2	P value
	n	%	n	%	n	%		
Gender								
Girl	6	40.0	7	46.7	7	46.7	0.180	.914
Boy	9	60.0	8	53.3	8	53.3		
Gestational Age at Birth								
38.0-39.0 weeks	10	66.7	11	73.3	12	80.0	0.682	.711
40.0-41.0 weeks	5	33.3	4	26.7	3	20.0		
Postnatal Age								
2-3 days	5	33.3	5	33.3	5	33.3	0.001	.999
4-5 days	10	66.7	10	66.7	10	66.7		
Body Weight During Study								
2500-2999 gm	7	46.7	2	13.3	8	53.3	5.861	.063
3000 gm and over	8	53.3	13	86.7	7	46.7		
Body Weight at Birth								
2500-2999 gm	7	46.7	2	13.3	7	46.7	4.849	.089
3000 gm and over	8	53.3	13	86.7	8	53.3		
Type of Birth								
Cesarean delivery	10	66.7	11	73.3	7	46.7	2.458	.293
Vaginal birth	5	33.3	4	26.7	8	53.3		

Abbreviation: χ^2 , Pearson Chi-Square.

Table 2 ALPS-Neo and ABSS Scores of Term Newborn Babies' Pre-Study, Post-Study 1st-Minute, and Post-Study 5th-Minute (n = 45)

Scales	Massage Group (n = 15)	Bath Group (n = 15)	Control Group (n = 15)	TEST
	$\bar{x} \pm SD$	$\bar{x} \pm SD$	$\bar{x} \pm SD$	
ALPS-Neo				
Pre-study	8.86 ± 5.86	3.26 ± 4.38	5.20 ± 6.36	$f = 7.826$ $P \leq .001$
Post-study 1st-minute	1.00 ± 1.41	1.13 ± 2.38	1.80 ± 3.25	$f = 1.324$ $P = .335$
Post-study 5th-minute	0.46 ± 1.06	1.53 ± 2.50	2.46 ± 3.27	$f = 9.436$ $P \leq .001$
TEST	$F = 13.000$ $P \leq .001$	$F = 2.454$ $P = .133$	$F = 2.000$ $P = .231$	
ABSS				
Pre-study	8.73 ± 6.44	6.26 ± 5.65	8.66 ± 7.97	$f = 2.321$ $P = .189$
Post-study 1st-minute	5.53 ± 4.82	8.46 ± 6.32	4.80 ± 5.29	$f = 1.874$ $P = .216$
Post-study 5th-minute	5.66 ± 4.80	6.00 ± 5.38	5.06 ± 4.60	$f = 0.836$ $P = .448$
TEST	$F = 3.906$ $P = .032$	$F = 0.889$ $P = .422$	$F = 2.033$ $P = .171$	

Abbreviations: F, Repeated measures ANOVA; f, One-way ANOVA.

however, no statistically significant differences were detected between the measurements ($P > .05$). It was also found that term newborns in the Lavender Massage Group had decreased ABSS scores at the 1st and 5th minutes after the study, and a statistically significant difference was detected between the scores before the study and at the 5th-minute after the study ($F = 3.906, P = .032$). Term newborns in the Lavender Bath and Control Groups had also decreased ABSS scores at the 1st and 5th minutes after the study, however, no statistically significant differences were detected between the measurements ($P > .05$) (Table 2 and Figure 2).

In the intergroup comparison, it was found that the massage group had higher mean ALPS-Neo scores before the study compared to the bath and control group ($f = 7.826, P \leq .001$), and lower mean scores at 5th-minute post-study ($f = 9.436, P \leq .001$). There was no statistical difference between the groups in terms of pre-study, post-study 1st-minute, and post-study 5th-minute ABSS mean scores ($P > .05$) (Table 2).

The mean difference between ALPS-Neo scores of the term newborns in the Lavender Massage Group was higher

Figure 2. Change in ALPS-Neo Scores of the Groups Over Time

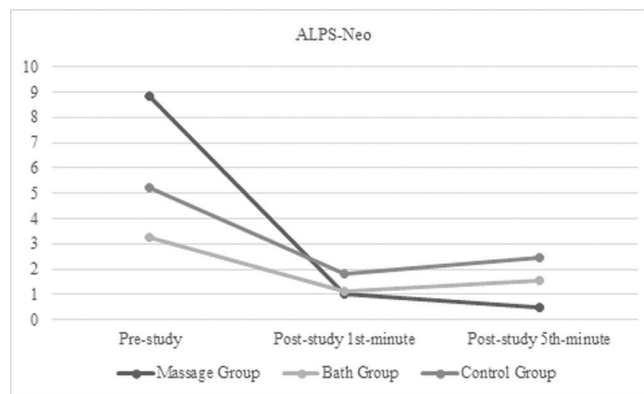


Table 3 Comparison of the Mean Difference Between ALPS-Neo and ABSS Post-Study 5th-Minute and Pre-Study in Term Newborn Babies (n = 45)

Scales	Massage Group (n = 15)	Bath Group (n = 15)	Control Group (n = 15)	f	P value
	$\bar{x} \pm SD$	$\bar{x} \pm SD$	$\bar{x} \pm SD$		
ALPS-Neo	8.40 ± 5.67	1.73 ± 4.60	2.73 ± 6.79	5.836	.006
ABSS	3.06 ± 5.59	0.26 ± 7.82	3.60 ± 9.50	0.789	.461

Abbreviation: f, One-Way ANOVA

than the other groups, and the difference was statistically significant ($f = 5.836, P = .006$) and no statistically significant differences were detected between the mean ABSS scores of the three groups ($P > .05$) (Table 3).

DISCUSSION

Aromatherapy is considered one of the holistic nursing tools and is used as a complementary treatment.¹⁴ It was reported in previous studies that aromatherapy with lavender oil helps in muscle relaxation and reduces stress and pain.⁶ It is reported in the literature that aromatherapy using lavender oil is applied to newborns with massage or bath methods. It has been determined in both methods that aromatherapy increases the sleep duration of newborns and infants and reduces sleep disorders, cortisol levels, colic symptoms, pain caused by invasive interventions, and pain during vaccine injection.¹¹⁻¹⁹ The efficacy of aromatherapy applied with massage and bath methods has been evaluated separately in the literature, however, their superiority to each other has not yet been evaluated. In the present study, it was found that the pain and stress scores of the newborns in the Lavender Massage Group decreased at the 5th minute after the study compared to the pre-study scores, and the difference was statistically significant ($P \leq .001$). The pain and stress scores of the newborns in the lavender bath and control groups decreased after the study, but the difference between the groups was not statistically significant ($P > .05$).

In the intergroup comparison, it was found that the massage group had higher mean ALPS-Neo scores before the study compared to the bath and control groups ($P \leq .001$), and lower mean scores at 5th-minute post-study ($P \leq .001$).

There was no statistical difference between the groups in terms of pre-study, post-study 1st-minute, and post-study 5th-minute ABSS mean scores ($P > .05$) (Table 2). Also, when the mean difference between the pain and stress scores of the newborns before and after the study were compared, it was found that the difference between pain and stress scores of the newborns in the Lavender Massage Group was higher than the newborns in the other groups ($P = .006$) (Table 3). According to these results, it can be argued that aromatherapy massage applied using lavender oil is more effective in reducing pain and stress in newborns compared to bath using lavender oil and no intervention.

The purpose of the care of newborns who react to the negative impacts of the NICU settings by showing physiological and behavioral stress symptoms is to preserve energy and to provide homeostasis.²⁴ For this reason, it is important to evaluate and regulate the behavioral status of newborns to ensure their healthy development.²⁵ It was determined in the study that the newborn behavior scores at the 5th-minute after the study decreased in the Lavender Massage Group compared to the pre-study scores, and the difference was statistically significant ($P = .032$). It was also determined that the behavior scores of the newborns decreased after the study in the lavender bath and control groups, but the differences were not statistically significant ($P > .05$) (Table 2). When the mean difference between the 5th-minute behavioral scores of newborns before and after the study was compared, no statistically significant differences were detected between the groups ($P > .05$) (Table 3). Previous studies report that massage with aromatherapy oils provides decreased motor activity, decreased stressful behaviors, and increased vagal activity in newborns.^{15,26} On the contrary, Field et al. (2006), reported that newborns who received moderate and light pressure massage exhibited less active sleep, restlessness, crying, and stress behaviors (hiccups),²⁷ however, such reports are infrequent. Based on this information, it can be argued that aromatherapy massage improves behavioral outcomes in newborns.

CONCLUSION

It can be argued that aromatherapy massage with lavender oil is more effective in reducing pain and stress levels and improving behavioral outcomes in newborns compared to the bath application by adding lavender oil. In line with the findings, the application of aromatherapy massage in newborns may be recommended in clinics and encourage parents about it. It is also recommended to conduct more studies to validate our findings, determine the effects of complementary therapies such as aromatherapy massage in newborns, and ensure that the results obtained are applied in clinics.

Limitations and Future Directions

This study provides strong evidence for pediatric nurses caring for newborns to use lavender oil to reduce stress and improve positive behaviors in newborns. However, this study

has some limitations. This study only provides evidence for the use of lavender oil but does not for other essential oils.

AUTHOR DISCLOSURE STATEMENT

The authors declare that they have no conflict of interest.

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