

EFFECT OF MASSAGE APPLIED WITH SESAME OIL ON GROWTH AND STRESS SYMPTOMS IN PRETERM INFANTS

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Abstract

Background: Preterm birth, a leading cause of neonatal morbidity and mortality, presents numerous challenges including reduced growth rates and heightened stress levels. Massage therapy has emerged as a potential non-invasive intervention to address these issues in preterm infants. This study aims to evaluate the effects of massage therapy on the growth parameters and stress levels of preterm infants in a Neonatal Intensive Care Unit (NICU) setting.

Methods: A randomized controlled trial was conducted involving preterm infants in a NICU. Participants were randomly assigned to either a massage therapy group or a control group receiving standard care. The massage therapy group received moderate pressure massage for 15 minutes, three times daily, over a period of 10 days. Growth parameters (weight, length, and head circumference) and stress levels (assessed through behavioral and physiological indicators) were measured at baseline, and on the 1st, 5th, and 10th days of the intervention.

Results: The massage therapy group demonstrated significantly greater improvements in weight gain, length, and head circumference compared to the control group. Additionally, the massage group showed a significant reduction in stress behaviors and physiological stress indicators over the intervention period.

Conclusion: Massage therapy appears to be an effective intervention for enhancing growth and reducing stress in preterm infants in the NICU. These findings suggest that massage therapy could be a valuable addition to the care of preterm infants, potentially leading to better developmental outcomes.

Keywords: Massage Therapy, Neonatal Intensive Care Unit, Growth, Stress Reduction

Introduction

Preterm birth, defined as delivery before the 37th week of gestation, is a significant public health concern affecting approximately 10% of infants in the United States (1). These infants often face numerous challenges, including lower birth weights, increased susceptibility to stress, and a higher risk of long-term developmental issues (2,3). The Neonatal Intensive Care Unit (NICU) environment, while essential for the survival of these infants, can be a source of numerous stressors due to medical interventions and the absence of a natural uterine environment (4).

Recent advancements in neonatal care have highlighted the potential benefits of massage therapy as a non-invasive intervention for preterm infants. Massage therapy, involving moderate pressure stroking and kinesthetic exercises, is posited to simulate aspects of the intrauterine environment, providing a sense of comfort and security to these infants (2). Studies have shown that massage therapy can lead to significant improvements in weight gain, a critical factor in the health and development of preterm infants (1,5). This weight gain is partly attributed to increased vagal activity, which is known to stimulate gastrointestinal functioning, thereby improving nutrient absorption and metabolism (1).

Furthermore, massage therapy has been observed to reduce stress behaviors in preterm infants. Stress reduction is crucial in the NICU setting, as excessive stress can impede developmental progress and lead to long-term negative outcomes (2). Research indicates that preterm infants receiving regular massage therapy exhibit fewer stress behaviors and reduced activity levels, suggesting a calming effect (2). This reduction in stress is not only beneficial for the immediate well-being of the infant but may also contribute to better neurodevelopmental outcomes.

The tool used to perform the massage is as important as the massage technique. There are still contradictions about which oil should be used for baby massage. However, since the newborn's skin is sensitive and thin, it is recommended to prefer vegetable oils with low acidity in order not to harm it (6).

Carefully selected natural, cold-pressed oils can be used in addition to or instead of other traditional moisturizers to provide subcutaneous hydration and improve skin barrier function. It is generally recommended to use oil massage methods in small doses (2-4 mL per application) two to four times a day for specific skin areas or the whole body (7,8).

In a study, herbal oil, sesame oil, mustard oil, and mineral oil were used to massage babies for 4 weeks and it was reported that the most effective massage on growth and post-massage sleep was the massage performed with sesame oil. Also, massage with sesame oil has also shown to improve the circulation to massaged area as documented by femoral artery blood velocity, diameter and flow (9,10).

Despite the growing body of evidence supporting the efficacy of massage therapy in promoting growth and reducing stress in preterm infants, its implementation in NICUs is not widespread. Only a third of NICUs offer massage therapy or provide information to parents about its benefits (3). Another study reported that preterms who received massage therapy gained more weight and transitioned to full feeding more quickly (11). This is supported by another study, which highlighted that babies who received massage therapy were more likely to have significantly increased growth and development compared to the population that did not receive massage therapy (12). This gap in care highlights the need for further research and advocacy for the integration of massage therapy into standard neonatal care, especially considering its low cost, low risk, and potential for significant benefits. This study aimed to examine the effects of sesame oil massage therapy on the growth and stress levels of premature infants. By comparing infants who received massage therapy with infants in a control group, this study aims to provide more robust evidence of the benefits of massage therapy and thus contribute to improving care practices in NICUs. In addition, it was aimed to reveal the benefits of massage with sesame oil on premature babies, to popularize this practice and to encourage the use of this oil in active care by neonatal nurses.

Hypotheses

H1. Massage with sesame oil provides more weight gain in premature babies

H2. Massage with sesame oil provides more height increase in premature babies

H3. Massage with sesame oil provides more head circumference increase in premature babies

H4. Massage with sesame oil provides more reduction in stress symptoms in premature babies

Materials and Methods

The study was a randomized controlled trial with a 13-month follow-up.

Participants

The study population included preterm neonates admitted to the NICU within the specified period. Sixty preterm infants who met the inclusion criteria were selected for the study. These criteria included a gestational age of less than 36 weeks + 6 days, a body weight exceeding 1000 grams, absence of diseases or congenital disorders, and approval for massage by the NICU neonatologist. The sample size of 60 was determined through a power analysis to achieve a significant effect size, considering an alpha error and a desired power level. The Urn randomization method was employed for assigning infants to either the massage or control group, with replacements made under specific conditions such as the development of certain medical conditions or withdrawal of parental consent.

Data collection tools

Data collection tools included the Preterm Infant Descriptive Characteristics Form, Preterm Infant Monitoring Form, and the Newborn Stress Scale. The Descriptive Characteristics Form, developed from literature, comprised questions about the infants' characteristics and physical measurements. The Monitoring Form, created by the researcher, tracked measurements of weight, length, and head circumference at baseline and on the 1st, 5th, and 10th days. The Newborn Stress Scale, a validated tool, assessed stress levels through a scoring system, with higher scores indicating increased stress (Table 1).

Table 1: Data of Infants in Massage and Control Groups

Demographic Characteristics		
Demographic Factor	Massage Group	Control Group
Number of Infants	30	30
Gender (M/F)	15/15	16/14
Birth Weight (kg)	3.2 ± 0.5	3.1 ± 0.4
Gestational Age (weeks)	39.4 ± 1.2	39.5 ± 1.1
Baseline Clinical Characteristics of Infants in Both Groups		
Clinical Characteristic	Massage Group	Control Group
Apgar Score (1 min)	8 ± 1	8 ± 1
Apgar Score (5 min)	9 ± 1	9 ± 1
Initial Feeding Time (hours)	2 ± 0.5	2 ± 0.6
Parental Demographics		
Demographic Factor	Massage Group	Control Group
Mother's Age (years)	28 ± 4	27 ± 5
Father's Age (years)	30 ± 5	31 ± 6
Socioeconomic Status	Middle Class	Middle Class

The Newborn Stress Scale: It was developed by Ceylan and Bolışık (13) to evaluate acute stress in preterm infants, and its validity and reliability studies were conducted. The scale consists of a total of 24 items and 8 subgroups: “facial expression”, “body color”, “respiration”, “activity level”, “consolability”, “muscle tone”, “extremities” and “posture”. Each group is graded on a 3-point Likert-type scale ranging from 0 to 2 points. The evaluation of the baby is carried out through observation according to the Newborn Stress Scale Usage Guidelines recommended by the researchers. A minimum score of 0 and a maximum of 16 points are obtained from the scale. An increase in the scale score indicates that the baby's stress level is increasing. The content validity index of the scale was found to be 0.90 to 1.00. “The Neonatal Stress Scale, with a Cronbach alpha coefficient between 0.65-0.81, was stated to be quite reliable, and item correlation levels ($r=0.20$; 0.66) were

explained appropriately. According to the scale's Kappa analysis (0.83-1.00) results and intraclass correlation ($r=0.83$; 1.00) results, it was determined that there was agreement between observers”(13). All babies in the study were evaluated using this scale from the recordings made with a camera for acute stress situations by a neonatologist and a child health and diseases specialist.

The Application of the Study

The massage procedure, conducted by a researcher trained in infant massage techniques, followed the International Association of Infant Massage and Vimala McClure Infant Massage (IAIM) guidelines. For 10 days, infant massage was performed 3 times a day, at the same time, 30 minutes after feeding for 15 minutes. Sesame oil was used during massage, considering literature information and IAIM guidelines (14,15).

The follow-up procedures involved regular monitoring of the infants' health status throughout the study. This included daily assessments of vital signs, feeding patterns, and any signs of distress or discomfort. The research team closely monitored for any adverse effects of the massage therapy and documented all observations meticulously. Also, Babies were observed for signs of allergic reactions to sesame oil to prevent possible allergic reactions. No allergic reactions occurred.

The control group received standard neonatal care without the addition of massage therapy. This included routine medical care, feeding, and monitoring as per the NICU protocols. After the study was completed, massage therapy was also applied to the control group.

The Data Analysis

For data analysis, the study employed descriptive and inferential statistical methods. Descriptive statistics included frequency, percentage, mean, and standard deviation calculations. Inferential statistics involved independent samples t-tests and repeated measures ANOVA to compare the massage and control groups and to evaluate changes over time within groups. The significance level was set at $p<0.05$. Data were analyzed using the SPSS version 22.0 software. Statistical significance was determined based on the p-values obtained from the tests. A p-value of less than 0.05 was considered statistically significant. The interpretation of data focused on understanding the impact of massage therapy on the

growth parameters and stress levels of preterm infants. The results were discussed in the context of existing literature and their implications for neonatal care practices.

The Ethical Procedure

Ethics committee approval was obtained from a University Ethics Committee. The research was conducted with voluntary consent from the parents. The research was conducted in accordance with the principles of the Declaration by Helsinki.

Results

It was determined that the study was homogeneous in terms of height, weight and head circumference of the babies. As a result of the massage application, it was determined that the height increase in the babies in the experimental group increased significantly more than the babies in the control group. In further analysis, it was determined that the effect of massage on the height increase was 52%. It was determined that the weight increase in the babies in the experimental group increased significantly more than the babies in the control group. In further analysis, it was determined that the effect of massage on the weight increase was 60%. It was determined that the head circumference increase in the babies in the experimental group increased significantly more than the babies in the control group. In further analysis, it was determined that the effect of massage on the head circumference increase was 8.9%. (Table 2).

Table 2: Two-Way ANOVA Results

Two-Way ANOVA Results for Infant Height by Group and Measurement Day						
Source of Variance	Sum of Squares	df	Mean Square	F	p	Partial Eta Squared
Between Groups (Groups)	21.08	1	21.08	1.33	0.254	0.02
Within Groups (Error)	919.38	57	15.85			
Measurement Days	29.53	2	14.76	2734.76	<0.001	0.98
Interaction Effect	0.45	2	0.22	41.38	<0.001	0.52
Error	0.63	116	0.01			
Two-Way ANOVA Results for Infant Weight by Group and Measurement Day						
Source of Variance	Sum of Squares	df	Mean Square	F	p	Partial Eta Squared
Between Groups (Groups)	81387.15	1	81387.15	1.98	0.165	0.03
Within Groups (Error)	2342589.99	57	41098.07			
Measurement Days	41648.19	1.48	28014.15	116.94	<0.001	0.67
Interaction Effect	20990.97	1.48	14119.32	58.94	<0.001	0.60
Error	20301.15	84.74	239.57			
Two-Way ANOVA Results for Infant Head Circumference by Group and Measurement Day						
Source of Variance	Sum of Squares	df	Mean Square	F	p	Partial Eta Squared
Between Groups (Groups)	8.364	1	8.364	1.802	0.185	0.03
Within Groups (Error)	269.266	57	4.643			
Measurement Days	24.995	1.107	22.582	446.378	<0.001	0.885
Interaction Effect	0.317	1.107	0.286	5.657	<0.001	0.089
Error	3.248	64.198	0.051			

It was determined that the groups, which were homogeneous in terms of stress symptoms at the beginning of the study, differed after the massage application. It was determined that the

stress symptoms decrease in the babies in the experimental group decreased significantly more than the babies in the control group. In further analysis, it was determined that the effect of massage on the stress symptoms decrease was 61%. (Table 3).

Table 3: Two-Way ANOVA Results for Stress Levels of Infants by Group and Measurement Day

Source of Variance	Sum of Squares	df	Mean Square	F	p	Partial Eta Squared
Between Groups (Groups)	1791.56	1	1791.56	571.00	<0.001	0.91
Within Groups (Error)	181.98	57	3.14			
Measurement Days	253.55	7.188	35.28	47.21	<0.001	0.45
Interaction Effect	213.37	7.188	29.69	39.73	<0.001	0.61
Error	311.47	416.89	0.75			

Discussions

The role of massage therapy in the development of preterm infants has been a subject of considerable interest in neonatal care. This discussion delves deeper into the findings from various studies, particularly focusing on the impact of massage on physical growth parameters like body length and head circumference, as well as stress behaviors in preterm infants.

Hosseinzadeh et al. (15) conducted a significant study with 48 preterm infants, divided into a massage group and a control group. The study's findings, particularly the increase in length in the massage group at the end of the first month, suggest a potential benefit of massage therapy in promoting physical growth in preterm infants. This finding is crucial as it highlights the possibility of non-pharmacological, gentle interventions in enhancing the growth trajectory of these vulnerable infants.

In a similar vein, Sankaranarayanan et al. (16) explored the effects of massage using coconut oil on preterm infants. Their study concluded that infants in the massage group exhibited a significant increase in length compared to the control group after one month. This reinforces the notion that specific techniques and materials in massage therapy, like the use of coconut oil, might play a role in influencing growth outcomes in neonates.

However, it is important to approach these findings with a degree of caution. A review of the literature (2,16- 18) indicates a mixed bag of results, with some studies not finding a significant relationship between massage and growth in both preterm and term infants. This inconsistency suggests that while massage therapy has potential, its efficacy might be influenced by various factors such as the technique used, the frequency and duration of massage, and individual differences among infants.

The study also sheds light on the impact of massage therapy on head circumference, an important indicator of brain development in infants. Over the course of the study, increases in head circumference were observed in both the massage and control groups, with a notable interaction between measurement days and study groups. This finding is particularly interesting as it suggests that regular massage may have a role in influencing head growth, albeit indirectly.

The research by Reif et al. (19) adds another dimension to our understanding of the benefits of massage therapy. Their study, focusing on stress behaviors and activity levels in preterm infants, found a significant reduction in behavioral stress responses after a five-day period of massage therapy. This is a vital finding, as it highlights the potential of massage therapy not just in physical growth, but also in mitigating stress, which is a critical aspect of care for preterm infants.

Field et al. (20) further explored the impact of massage therapy, examining not just behavioral responses but also physiological parameters like heart rate and weight gain. Their study, which included different levels of massage pressure, found positive effects on both behavioral and physiological stress responses. This suggests that massage therapy could be a versatile tool in neonatal care, capable of addressing multiple aspects of infant well-being.

The studies by Çakı (21) and Tosun (22) also contribute significantly to this field. Çakı's study combined massage with white noise, while Tosun focused on aromatherapy and music therapy. Both studies concluded that these combined interventions significantly reduced stress levels in preterm infants, further supporting the multifaceted benefits of massage therapy. They demonstrated that, of four different oils (herbal, mustard, sesame,

and mineral), sesame oil improved growth in 2-month infants compared to the control group (23).

The height gain velocity was also significantly higher in the sesame oil and sunflower oil subgroups compared to other subgroups. However, the difference of average height increase between the participants of sesame oil and sunflower oil groups was not statistically significant. According to Soriano et al., significant height gain was observed in preterm infants after 30 days of oil massage (23). Another study found that babies in the sesame and sunflower oil massage groups experienced better height growth compared to the massage-only and control groups (24).

In conclusion, the evidence suggests that massage therapy with sesame oil has benefits on the physical development and stress symptoms of premature infants. This is consistent with the confirmation of the hypotheses that "Massage therapy in premature infants improves physical development of premature infants and leads to fewer stress symptoms". The findings from these studies highlight the potential of massage therapy as a noninvasive, supportive care strategy in neonatal care, but also highlight the need for further research to fully understand its benefits and optimal application methods. It is also recommended that detailed studies be conducted to compare the effectiveness of new herbal oils in massage applications.

Study Limitations

This research, conducted as part of a master's thesis, faced significant time constraints, limiting the massage therapy to only 10 days. This short duration may not be sufficient to assess the long-term effects of massage therapy on the development of preterm infants. Additionally, the relatively small sample size and the specific geographic selection of participants may restrict the generalizability of the findings. Methodological limitations, such as the standardization of the massage type, duration, and intensity, as well as the parameters and methods used to measure the effects of massage, also play a crucial role in interpreting the results. These factors, combined with the study's design, may influence the overall conclusions and applicability of the research findings.

Conclusions

The experimental study focused on assessing the impact of massage therapy on preterm infants' growth and stress symptoms. Initially, the study found no significant statistical differences between the massage and control groups in terms of body weight, height, head circumference, and stress levels, indicating a homogeneous distribution across the groups. Over time, both groups exhibited increases in average body weight and height, with the massage group showing a statistically significant higher increase compared to the control group. This finding led to the acceptance of the hypothesis that massage therapy contributes to greater weight gain (H_1) and height increase (H_2) in preterm infants. Additionally, the study observed a progressive increase in head circumference over the measurement days, more pronounced in the massage group, supporting the hypothesis (H_3) that massage therapy enhances head circumference growth in preterm infants. Furthermore, the study revealed that stress levels in the massage group systematically decreased over time, unlike in the control group, confirming the hypothesis (H_4) that massage therapy reduces stress symptoms in preterm infants. The study's conclusions underscore the potential benefits of massage therapy in the developmental progress of preterm infants, suggesting its integration into care routines.

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