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*Research Article*

# The Effect of Combined Stimulation of Baby Massage and Lavender Essential Oil on Gross and Fine Motor Skills in Infants Aged 3–12

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**Abstract:** Gross motor and fine motor development are critical aspects of early childhood growth, yet a significant proportion of infants and toddlers continue to experience delays in these areas. According to the World Health Organization (WHO) in 2016, approximately 20–40% of infants aged 0–2 years face delays in developmental processes, with 5–25% experiencing gross and fine motor disorders. Delays in gross motor skills can reduce adaptability and creativity during the adaptation period, while delays in fine motor skills may hinder a child's learning process. Beyond adequate nutrition provided by the mother, stimulation is an essential strategy to optimize growth and development. One promising approach is the combination of baby massage and lavender essential oil, which may offer both physical stimulation and relaxation benefits that support motor skill advancement. This study aims to determine the effect of combined baby massage stimulation and lavender essential oil application on the improvement of gross and fine motor skills in infants aged 3–12 months. A pre-experimental quantitative design with one-group pretest–posttest was applied to a sample of 40 infants. Data analysis employed the Wilcoxon signed-rank test to assess changes in motor development scores before and after the intervention. Results indicated a probability value (p-value) of 0.02 (<0.05), suggesting a statistically significant improvement in both gross and fine motor skills following the intervention. These findings highlight the potential of integrating tactile and aromatherapy-based stimulation into infant care routines to enhance motor development. Further research with larger and more diverse samples is recommended to validate these results and explore the underlying mechanisms of action.

**Keywords:** baby massage; fine motor; gross motor; infant development; lavender essential oil

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## 1. Introduction

Infancy is known as the golden period, which is a critical phase where growth and development require optimal stimulation (1)(2). Infant growth and development consist of gross motor and fine motor development. Gross motor development refers to the ability to move body parts, while fine motor development refers to the maturity and control of body movements (3).

The aspects of gross and fine motor development in infants are closely related and interconnected. If one aspect of development does not progress well, it will affect the development of the other. Success in achieving developmental tasks during infancy will determine the success of subsequent developmental stages experienced by the child (4).
According to the World Health Organization (WHO) in 2016, globally around 20–40% of infants aged 0–2 years experience developmental delays. Additionally, 5–25% of toddlers experience gross and fine motor disorders. The prevalence of developmental disorders in children remains high across both developed and developing countries, with rates reported at approximately 12–16% in the United States and 24% in Thailand.

Argentina reports a prevalence of 22%, while in Indonesia it ranges from 13–18% (5)(6). Factors that influence infant growth and development include nutrition and stimulation (7)(8). The impact of delayed gross motor development in infants can lead to a decline in creativity and adaptability. Research in Indonesia shows that 20–30% of toddlers experience developmental disorders, with the majority having delays in gross motor and verbal language development—most of which are attributed to a lack of adequate stimulation (3)(9).

According to the Bengkulu Provincial Health Profile (2018), out of 7,025 infants, 6,752 (96%) received health services, based on data from regencies/cities in Bengkulu Province. Infant health services are provided at least four times: once between 29 days–2 months of age, once between 3–5 months, once between 6–8 months, and once between 9–11 months. One method to stimulate gross and fine motor skills in infants is through play. During play, parts of the infant's body—such as the neck, torso, legs, arms, and fingers—can be stimulated. Fine motor skills are trained through actions like grabbing toys, touching, and holding objects with the fingers (10).

Aromatherapy is known to help stimulate infants' sensory perception and is considered an alternative therapy. In developed countries such as the United States, France, and the United Kingdom, aromatherapy has become part of complementary medical therapy and is used by experts to reduce stress, improve function, and enhance concentration (11).

Lavender essential oil is a type of aromatherapy that is effective and gentle in improving overall health, alleviating mild disorders, and promoting relaxation. It contains a high concentration of esters (approximately 26%–52%), which can provide a calming effect directly on the central nervous system. Lavender is known to influence the amygdala in the brain, producing a soothing and relaxing effect (12). Aromatherapy using lavender essential oil has been shown to be effective in improving sleep quality in infants aged 3–12 months (13). One of the mechanisms of action of lavender essential oil is that its aroma is absorbed through inhalation, which reduces cortisol secretion and increases serotonin levels (14).

One intervention that can help address these issues is the combination of baby massage and lavender essential oil stimulation. Baby massage is a form of stimulation that supports the development of both the structure and function of brain cells. Infants who receive massages for approximately 15 minutes tend to feel more relaxed, sleep more soundly, and experience better growth and development (15).

Monitoring and stimulating infant growth and development is one of the key responsibilities of midwives. In accordance with the Decree of the Minister of Health of the Republic of Indonesia Number 369/Department of Health/SK/III/2017 concerning Professional Midwifery Standards, baby massage combined with lavender essential oil is one form of stimulation developed to support infant growth and development.

## 2. Research methods

This study used a quantitative pre-experimental design with a one-group pretest-posttest approach. The sample consisted of 40 infants aged 3–12 months. Data analysis to assess the effect on improvements in gross and fine motor skills was conducted using the paired t-test. The intervention was given for 4 weeks, with two sessions per week consisting of combined baby massage and lavender essential oil stimulation. Evaluation was then carried out using the Developmental Screening Questionnaire (Kuesioner Pra Skrining Perkembangan, KPSP), which consists of 10 assessment items covering gross motor skills, fine motor skills, social independence, and verbal ability.

## 3. Result and Discussion

### a. Univariate Analysis

**Table 1.** Frequency Distribution of Respondent Characteristics, Including Gender, Age, Birth Length, and Birth Weight.

| Variabel | Intervensi (n=40) | |
|---|---|---|
| | N | % |
| **Gender** | | |
| a. Boy | 19 | 47.5 |
| b. Girl | 21 | 52.5 |
| **Age** | | |
| a. 3-5 months | 15 | 75.0 |
| b. 6-8 months | 8 | 40.0 |
| c. 9-11 months | 10 | 50.0 |
| d.12 months | 7 | 35.0 |
| **Birth Length (cm)** | | |
| a. 50-60 | 16 | 80.0 |
| b. 61-70 | 17 | 85.0 |
| c. 71-80 | 7 | 35.0 |
| **Birth Weight (kg)** | | |
| a. 5.0-6.9 | 12 | 60.0 |
| b. 7.0-8.9 | 19 | 95.0 |
| c. 9.0-10.0 | 9 | 45.0 |

Based on Table 1, the frequency distribution of respondent characteristics shows that the majority were female (52.5%), aged 3–5 months (75.0%), with a birth length of 61–70 cm (85.0%), and a birth weight of 7.0–8.9 kg (95.0%).

### b. Bivariate Analysis

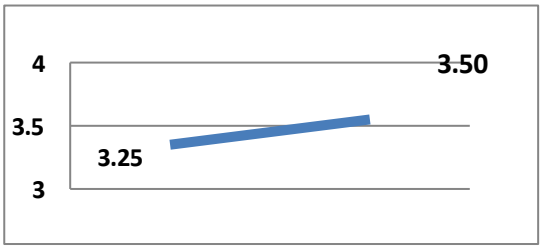


**Figure 1. Gross Motor Skills Results**

Using the mean test to assess the differences in development before and after the intervention was conducted.

Figure 1 shows an increase in gross motor development with a mean score of 3.25 before and 3.50 after the intervention using combined baby massage stimulation and lavender essential oil.

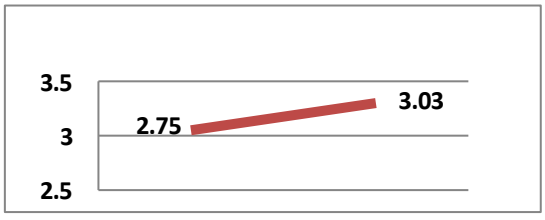


**Figure 2. Fine Motor Skills Results**

Figure 2 shows the results of fine motor skills before and after the intervention.Figure 2 shows an increase in fine motor development with a mean score of 2.75 before and 3.03 after the intervention using combined baby massage stimulation and lavender essential oil.

**c. Analysis of the Effect on Gross and Fine Motor Skills Before and After the Intervention**

**Table 2.** Differences in Gross and Fine Motor Skill

| Variabel | N | min | Max | Sd | Mean | Beda mean | P value |
|---|---|---|---|---|---|---|---|
| M. Kasar | | | | | | | |
| **Pretest** | **40** | **2** | **4** | **0,670** | **3,25** | **0,25** | **0,02** |
| **Postest** | **40** | **2** | **4** | **0,555** | **3,50** | | |
| **Motorik halus** | | | | | | | |
| **preteset** | **40** | **1** | **4** | **0,93** | **2,75** | **0,28** | **0,02** |
| **Postest** | **40** | **1** | **4** | **0,920** | **3.03** | | |

The Wilcoxon Rank Test was conducted to examine the effect of development before and after the intervention of combined baby massage stimulation and lavender essential oil on gross and fine motor skills in infants aged 3–12 months.

Table 2. Differences in Gross and Fine Motor Skills Before and After the Intervention of Combined Baby Massage Stimulation and Lavender Essential Oil

Based on Table 3, the bivariate analysis results (n=40) using the Wilcoxon test showed a mean score of 3.25 (SD 0.670) before the intervention and a mean score of 3.50 (SD 0.555) after the intervention, with a mean difference of 0.25 and a significance value (p-value) of 0.02. This indicates a significant difference in gross motor skills improvement following the combined intervention of baby massage stimulation and lavender essential oil. Meanwhile, for fine motor skills, the mean score before the intervention was 2.75 (SD 0.93) and increased to 3.03 (SD 0.920) after the intervention, with a mean difference of 0.28 and a p-value of 0.02, also indicating a significant improvement.

**d. The Influence of Combined Baby Massage Stimulation and Lavender Essential Oil on Gross and Fine Motor Skills in Infants Aged 3-12 Months**

The study results showed an improvement in gross motor skill development before and after the combined intervention of baby massage stimulation and lavender essential oil, with a significant p-value of 0.02. Similarly, fine motor skills also showed significant improvement before and after the intervention with a p-value of 0.02.

Growth is a process of physical change and an increase in body size that varies among individuals. Development, on the other hand, is the progressive maturation of abilities, skills, and body functions that are more complex, including gross motor, fine motor, speech, social skills, and independence, which each individual acquires to adapt to their environment. Factors influencing growth and development include adequate nutrition, sensory stimulation, regular physical activities, and a supportive environment (18).

Infant abilities and development can be encouraged through stimulation or interaction, such as baby massage. Baby massage is a gentle touch technique performed regularly or by touching the infant's body to induce comfort. The gentle touch given to the baby through massage, when performed regularly and following proper massage techniques, can be a beneficial and effective therapy for infants, such as increasing body weight and growth, improving sleep patterns, enhancing concentration, reducing stress levels, and fostering a close bond between caregivers and infants (17).

Massage stimulation on infants is a beneficial sensory touch that encourages and accelerates motor development. Gentle touch during baby massage directly interacts with nerve endings on the skin surface, transmitting messages to the brain through spinal nerve pathways. Touch also

stimulates internal circulation, increasing oxygen delivery throughout the body, creating a balance between movement organs and the brain that helps accelerate motor development in infants (18).

Baby massage also stimulates tactile senses, which promotes the infant's development of increasingly complex, coordinated movements that strengthen muscles. Activation of the vagus nerve increases the secretion of enzymes for gastric absorption and insulin. Insulin plays a role in carbohydrate metabolism, glycogen storage, and fat synthesis stored in the liver, fat tissue, and muscles. Glycogen produces ATP (Adenosine Triphosphate), which functions for muscle contraction. Adequate ATP availability makes infants more active in motor activities, thus accelerating motor development. This is supported by massage techniques applied to the infant's body that stimulate or encourage coordination between small and large muscles, allowing infants to crawl, roll, hold objects, and coordinate movements through nerve pathways. In this study, the infant massage was performed with verbal interaction.

Thus, it can stimulate the development of infant motor skills (10)(18). The results of this study align with the research by The Brazelton Neonatal Behavioral Assessment Scale, which showed that infants who received massage experienced significant motor development improvements compared to those who did not. Infants can undergo development more optimally when they receive tactile stimulation on the skin, which provides a calming effect and enhances neurological development, thereby accelerating motor development.

Several previous studies have also reported the influence of infant massage stimulation on the growth and development of infants aged 6-12 months.

In PMB Halnal (18), it was found that baby massage affects the development of gross motor skills in babies aged 6-9 months at My Baby SPAL Surabaya (6). Baby massage also influences the development of fine motor skills in babies aged 3-6 months in the working area of the Antang City Health Center, Makassar, in 2021 (19). Baby massage affects the growth and development of babies aged 0-12 months at the Malhalnum Husada Clinic, Medan, in 2022 (20).

Aromatherapy, also known as essential oils, is used to improve both physical and emotional health. Aromatherapy molecules have a small molecular structure that allows them to penetrate the skin to the epidermal layer. These molecules can easily spread throughout the body via the lymphatic system, blood vessels, nerves, collagen, fibroblasts, mast cells, and other tissues. Furthermore, aromatherapy molecules send signals to the brain, releasing various neurochemicals such as relaxants, stimulants, sedatives, and euphoric agents (21)(22). Aromatherapy is an alternative therapy that can provide physical and mental health benefits. In America, Europe, England, and other developed countries, aromatherapy has become a form of medical therapy. Aromatherapy is used by health professionals to treat certain conditions, improve sleep quality, and increase concentration (11).

Massage combined with aromatherapy is a relaxation technique that can stimulate the parasympathetic nervous system, resulting in relaxation, reduced stress, and relief from fatigue. During massage, muscle contractions stimulate the nervous system around the muscle area, causing muscle relaxation and increasing the activity of the hormone acetylcholine. Inhaling aromatherapy can also increase the frequency of alpha brain waves and induce relaxation. Lavender essential oil provides a relaxing effect on the central nervous system by helping increase oxytocin production. Lavender is one of the aromatherapy oils that affects the amygdala in the brain and can produce calming effects (12).

Massage combined with aromatherapy stimulates the distribution of molecules that penetrate the skin and stimulate the central nervous system, useful for relaxation and calming. Lavender essential oil used during baby massage makes babies more comfortable, improves sleep quality,

lengthens and deepens sleep, reduces the frequency of waking, decreases fussiness, and increases cheerfulness, which can help optimize growth and development (23).

Several studies report improved sleep quality after baby massage with lavender essential oil in babies aged 3-6 months at PMB Sentral Filtrilal Kotal Padang (23), Cilgalong Health Center in Majalengka Regency (24), and BPM Ilinal Mursinal Cikupal Talangerang (13).

## 4. Conclusions

Based on the results of research conducted by researchers, it was found that the combination of baby massage and lavender essential oil influences the development of gross and fine motor skills in babies aged 3-12 months, with a significant value (p-value) of 0.02. From these research results, it can be concluded that good health is important to provide more education to mothers who have babies aged 3-12 months about the importance of baby massage for the optimal growth and development of babies.

The limitation of this research is that it does not examine the factors that influence the growth and development of babies aged 3-12 months.

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