The Effect of Massage on the Development of 3-Month-Old Babies

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ABSTRAK

Infant development is a crucial Element of a kid's maturation and progress encompassing motor, language, social, and cognitive skills. Early stimulation, such as infant massage, can stimulate the core neurological framework manages essential physiological processes and accelerate the achievement of age-appropriate developmental milestones. This research intended to evaluate the effect of infant massage on babies' development aged three months. The study employed a semi-experimental approach utilizing a before-and-after evaluation with a comparison group structure. The participants were made up of 70 3-month-old infants, divided into two groups: 35 in the therapy cluster at Balowerti Community Health Center and 35 in the control group at Sukorame Public Wellness Facility. The selection method applied was purposive sampling. The intervention provided to the treatment group consisted of 15 minutes of infant massage twice a week for four weeks, performed by trained mothers. The control group received only standard developmental monitoring care. Developmental data were measured using the Pre-Developmental Screening Questionnaire (KPSP). Analysis used the Mann-Whitney U Test and the Wilcoxon Signed Rank Test. The findings indicated a notable improvement in developmental metrics among the intervention group (mean increased from 5.49 to 7.06; Z = -4.326; p = 0.000), Meanwhile, the control group exhibited no substantial variation (p = 0.343). Regular infant massage is effective in improving the development of 3-month-old infants. Massage can be incorporated into a family-based early stimulation program.

INTRODUCTION

Globally, around 45 million children below age 5 are projected to suffer from wasting by 2022 (being too thin for their height) (WHO, 2022) ccording to the 2023 Indonesian Health Survey, 5% of infants aged 0-11 months are underweight (Ministry of Health, 2024). The incidence in East Java Province is 6.8% (East Java Health Office, 2023), and in Kediri City, the rate of malnutrition is 2.0% (Satu-Data kediri, 2023)

Factors contributing to infant malnutrition include maternal factors, infant factors, environmental factors, and social and economic factors (Chabeda *et al.*, 2021), Maternal factors include poor maternal nutrition, which leads to suboptimal breast milk

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production, and mothers' lack of knowledge about proper breastfeeding techniques (Chabeda *et al.*, 2021). Factors that contribute to infants experiencing prematurity (Fleiss, Tarun and Polin, 2022) include gastrointestinal infections and congenital abnormalities that can hinder feeding or nutrition (Chairiyah *et al.*, 2023). Environmental factors can also contribute to malnutrition in infants, as poor hygiene can increase the risk of infection.

Infant malnutrition can be linked to a heightened likelihood of mortality, illness, resulting undernourishment, and hindered physical and cognitive progress (Grijalva-Eternod et al., 2021). Infants younger than half a year are diminutive and face dietary vulnerability, exhibiting multiple types of physical growth impairments (wasting or stunting) or low birth weight. Infection, which is a major cause of death, has long-term impacts on future growth and development and can have serious health consequences, including stunting (Ministry of Health, 2023), cognitive problems, delayed milestones, hypoglycemic immunosuppression, and low intelligence quotient (IQ) (Lyimo and Moshi, 2024). In addition to nutritional status, stimulation also plays a crucial role in supporting infant growth and development. Lack of stimulation can result in developmental delays and even risk permanent disorders (Rohmah, Ilmu Kesehatan and Studi Magister Kebidanan, 2024)

Non-pharmacological therapy is currently widely used in various circles, one of which is massage. Massage has various concepts, such as providing touch, with systematic and targeted massage stimulation provided by human hands. Manual therapy is commonly paired with additional kinds of sensory engagement, such as rhythmic motion, bodily stimulation (e.g., passive arm and leg exercises), conversation, or mutual eye contact (de Britto Pereira et al., 2021); (Devaguru et al., 2023). Infant massage consists of a series of smooth and slow movements performed starting from the feet, then to the stomach, chest, face, hands, and back. This activity is a form of tactile stimulation that serves a vital function in fostering the infant's progress and advancement process (Puji Lestari, Rahma Nurbadlina and Jauhar, 2021) ; (Rohmah, Ilmu Kesehatan and Studi Magister Kebidanan, 2024). Touch and other stimulation can be provided by

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health workers, parents, and other health workers (Lathifah and Rahmani, 2020). Growth represents the act of elevating the structural and functional abilities of an individual's psychomotor development, which involves the specialization of biological units, tissues, organs, and organ systems as seen from the aspect of functional abilities, such as cognitive, motor, social, emotional, language, and independence (Abidanovanty, Suryawan and Hendarto, 2023) (Rivanica and Oxyandi, 2020). Optimal child development and growth are the outcome of the interplay between multiple elements that influence each other, such as genetic factors, environment, behavior, and the provision of positive stimulation (Mrljak et al., 2022). Children who regularly receive stimulation tend to have better concentration and faster development than children who rarely or never receive stimulation (Desi Handayani Lubis, Yulia Safitri and Alfi Laili, 2022).

Previous researchers conducted massage therapy twice a week to study infant growth for 10-15 minutes before bathing 16 infants. They found a 500-gram variation in body mass increase prior to and following the treatment. Previous research has shown that infants who receive massage and movement exercises experience faster growth and development than those who do not (Khairina Afrida and Ardiansyah, 2024); (Sutiawati et al., 2025). The massage study also found no side effects from the massage intervention. (Liao et al., 2021)

While previous research involved trained nurses, the current study involves the infants' mothers. The touch training provided by researchers to mothers strengthens the parent-infant relationship (Lyimo and Moshi, 2024) and supports the physical, emotional, social, financial, and mental advancement of a minor from childhood to full age (Fitria Sandi and Pratiwi Yosin, no date) Attachment is an emotional and expected bond between mother and baby that begins in the first days of life. Before conducting the study, researchers surveyed both community health centers (Puskesmas) and obtained data on 436 3-month-old infants at the Balowerti Community Health Center and 320 at the Sukorame Community Health Center in 2024. This study will be conducted at the Balowerti Community Health Center and

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Sukorame Community Health Center from April 16 to June 14, 2025.

RESEARCH METHODS

Research Design

This research applied a semi-experimental framework employing a before-and-after assessment with a comparison group method.

Research Location and Time

This research was carried out in the operational zones of Balowerti Primary Health Facility (intervention cluster) and Sukorame Primary Health Facility (comparison cluster). The research duration spanned from April 16 to June 14, 2025.

Population and Sample

The participants involved in this research was 3-month-old infants at the Balowerti Community Health Center and the Sukorame Community Health Center from January to March 2025. The sample consisted of all 3-month-old infants at the Balowerti Community Health Center and the Sukorame Community Health Center who met the inclusion and exclusion criteria.

Sampling Technique

This research employed a purposive sampling method.

"Inclusion and Exclusion Criteria"

The eligibility requirements for this research included mothers of 3-month-old infants registered on their family cards within the working areas of the Balowerti and Sukorame Community Health Centers, infants without pre-existing conditions, and mothers who chose to be involved by endorsing a formal permission form.

Disqualification standards encompassed infants with pre-existing conditions (heart disease, asthma, etc.), infants with fever (≥37.5), and infants with sensitive skin.

Research Instrument

The research instrument used to measure infant development was the 2018 Pre-Screening Development Questionnaire (KPSP) for 3-month-old infants "from the Ministry of Health of the Republic of Indonesia."

Data Collection Techniques

In the treatment group, data collection techniques included providing an explanation of the research, obtaining informed consent, interviewing respondents, providing massage training, conducting a pre-test, providing a 15-minute touch training intervention for mothers to provide to their babies, providing positive suggestions or affirmations twice a

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week for four weeks, conducting a post-test, and processing data.

In the intervention group, an explanation of the research, obtaining informed consent, interviewing respondents, providing massage training, conducting a pre-test, a post-test, and processing data.

Analysis

The information was examined using SPSS version 23 (IBM Corp, 2019, USA).

Statistical tests used Levene's test procedure to determine whether the two groups of sample data came from the same population, Wilcoxon's Paired Rank Test was used to assess variations in progress metrics within a cohort, while Mann–Whitney U Test was applied to evaluate differences in progress outcomes between the experimental and comparison groups.

Research Ethics

This study has obtained ethical approval from the "Health Research Ethics Committee" of the Kediri Baptist Hospital College of Health Sciences. Number: 001/14/11/EC/KEPK-3/STIKES RSBK/2025. Date: February 14, 2025.

RESULTS AND DISCUSSION

Table 1. Respondent Characteristics

Characteristics	Growth and Development Characteristics				p-value
	Massage group (N=35)		Non-massage group (N=35)		
	F	%	F	%	
	(Mean ± SD)		(Mean ± SD)		
Birth Weight	3065 (37.9)		3018.5 (420.7)		0.179
Body Length	48.83 (1.871)		48.84 (2.830)		0.493
Head Circumference	32.74 (1.067)		32.77 (1.573)		0.570
Gender					0.920
Female	21	40	14	40	
	14	60	21	60	
Male	25.4	4.63(	30.3	6.065	0.060
Mother's Education					0.148
Low	3	8.6	6	17.1	
Medium	23	64.7	23	65.7	
High	9	25.7	6	17.1	
Mother's Job					0.399
Entrepreneur	2	5.7	0	0.0	
Private Employee	4	11	4	11.4	
Civil Servant	4	11	3	8.6	
Trader	2	6	1	2.9	
Unemployed	23	66	27	77.1	
Development	31.77 (1112)		39.23 (1373)		

Levene

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Table 1 presents the features of the respondents in this study: 70 3-month-old infants, evenly divided into 35 subjects in the experimental cluster within the Balowerti Community Health Center (Puskesmas) and 35 subjects in the control group within the Sukorame Community Health Center. Both groups were selected using a purposive sampling technique, which aims to select samples according to the study's inclusion criteria. This is crucial in experimental research to minimize differences in baseline characteristics between groups.

Based on anthropometric data, infant weight at baseline was generally within the normal range according to the 2023 Indonesian Ministry of Health Child Anthropometric Standards, with most infants weighing between 5.4–7.2 kg. Weight is a key indicator of infant growth and is significantly influenced by nutritional intake and the efficiency of the infant's digestive system. Infants with normal weight demonstrate optimal growth and development, especially when supported by additional stimulation such as infant massage.

Body length and head circumference were also included in age-appropriate categories. The majority of infants' body lengths ranged from 58–63 cm, and head circumferences ranged from 38–41 cm. Head circumference is used as an indicator of infant brain development, and growth in body length reflects long-term nutritional status. This assessment is important for detecting stunting and growth retardation early (WHO, 2022). The infants' genders in this study were relatively balanced in both the intervention and control groups, contributing to sample homogeneity. This is important considering that several studies have shown that the growth of male and female infants can differ, but at an early age (0–6 months), these differences are not yet significant and do not significantly affect data validity (Azijah and Adawiyah, 2020). The difference in weight between male and female infants is a biological phenomenon observed from birth. In general, male infants weigh slightly more than female infants. This is due to several factors, including hormonal differences, genetics, and body composition. Male fetuses are known to produce the hormone testosterone during pregnancy, which plays a role in stimulating the growth of muscle tissue and organs throughout the body. This

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causes boys to grow faster and gain more body mass (Kliegman et al., 2016). Furthermore, genetic factors also play a role. The presence of a Y chromosome in male fetuses stimulates the expression of (Kliegman et al., 2016) genes related to body mass and muscle development, thus triggering more rapid physical growth than in female fetuses. On the other hand, female fetuses tend to store more body fat, which, while important for hormonal function, does not significantly impact total body weight (WHO, 2022)

Maternal factors were also considered, although not considered a primary variable in the study. All mothers of infants in the massage intervention group received training in standard infant massage techniques based on guidelines by (McClure, 2017) and (Roesli, 2016), enabling the intervention to be carried out consistently and safely. Maternal involvement in massage positively impacts the emotional bond between mother and infant and increases maternal self-confidence in parenting. Bonding-attachment theory suggests that physical interactions such as touch and massage can strengthen the bond between mother and child (Sutarmi et al., 2022), which also psychologically impacts the infant's social and emotional development. (McClure, 2017)

On the other hand, the control group received standard care, including growth and development monitoring without any additional treatment. This aimed to provide a fair comparison between infants who received massage stimulation and those who did not. This routine monitoring included anthropometric measurements, but without direct therapeutic touch intervention.

The relatively homogeneous characteristics between the two groups, including infant age, initial nutritional status, and general health, indicate that both groups had similar baseline conditions. Therefore, any significant changes in growth and development can be more validly attributed to the infant massage intervention, which served as the independent variable in this study.

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Table 2. Infant development before and after massage therapy in the Intervention group.

Characteristics	Massage Group (n=35)		*P-Value*
	Pre-Test	Post-Test	
Age-Appropriate	12	35	
Doubtful	12	0	0.000
Deviation	11	0	

Description: Wilcoxon signed rank test

The findings of the research further indicated that infants in the intervention group experienced significant developmental improvements after receiving massage therapy. Based on the evaluation using the Developmental Pre-Screening Questionnaire, infant development was observed to improve in large-scale movements, precise hand functions, and interpersonal awareness showed a statistically meaningful improvement, as indicated by a p-value of 0.000 reflecting significant developmental change pre- and post-intervention.

The results showed that regular massage therapy for 3-month-old infants had a positive and significant impact on various aspects of growth, including large muscle coordination, small muscle coordination, and communication abilities, with social responsiveness and independence. Infant development scores that were previously in the "questionable" or "age-appropriate but low" category improved to "age-appropriate" after two weeks of intervention.

Infant massage is not only a physical intervention but also an effective neurological stimulation. Massage involves more than just pressure on the skin; it stimulates the central nervous system, accelerates brain maturation, and strengthens synaptic connections between neurons (Nur *et al.*, 2020). The results of improvements in the motor and social development aspects of babies after massage support the developmental theory, which states that early stimulation can accelerate the achievement of children's growth and development milestones, especially during the golden age of brain development.

Researchers state that infant massage fosters emotional closeness between mother and baby. During the massage, nonverbal communication occurs through gentle touch, eye contact, and the mother's soothing voice. These interactions play a vital role in supporting the infant's social and emotional development, an aspect of development that cannot be fully

achieved through medical intervention alone.

Researchers have observed that infant massage also has positive effects on mothers. They become more confident in caring for their babies, feel more emotionally connected, and are more sensitive to their babies' responses. This supports the notion that massage also empowers mothers in the parenting process, aligning with a holistic approach to family-based child health care.

Infant massage interventions can accelerate neurological development and strengthen the parent-child emotional bond (Widyani Heriyanti, Purnamasari and Suminar, 2025). Researchers believe that the effects of massage are not only short-term but can also lead to improvements in the quality of relationships, social development, and even emotional regulation in children in the future.

This corresponds with the theory described by (McClure, 2017) in the theoretical review, infant massage is not only shown to provide physiological benefits but also strengthens the emotional bond between mother and baby. Moreover, it enhances comfort, a sense of security, and sensitivity to the surrounding environment. All of these elements play a crucial role in supporting the infant's neurological development.

Table 3. The development of the baby before and after in the control group

Characteristics	Non-Massage Group (n=35)		p-value
	Pre-Test	Post-test	
Age-Appropriate	4	26	
Doubtful	17	4	0.000
Deviation	14	5	

Description: *Wilcoxon signed rank test*

In Table 3, the infants' overall development in the non-massage group did not show significant improvement. Based on the Wilcoxon test, most infants experienced stagnation or a decline in developmental rankings, as indicated by a Z-value of -4.206 and p = 0.000. This means that the majority of infants in the control group did not experience significant developmental progress during the observation period.

The group that did not receive massage therapy tended to stagnate in development, with some even showing a downward trend in scores based on the Pre-Developmental Screening Questionnaire (KPSP). Statistically, the changes before and after in the non-massage group were significant, but the direction of the changes was negative, not upward. This finding provides a

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crucial warning. The early stages of a baby's life, particularly between 0 and 6 months of age, are a critical period highly sensitive to environmental stimuli, including physical, emotional, and social stimuli. When infants are not provided with additional stimulation, such as massage, they rely solely on passive stimulation from their surroundings, which may not be sufficient to support optimal development.

Child development is not an automatic process that occurs over time; it requires active support from the environment, especially parents. In the context of the non-massage group, the absence of massage intervention deprived the infant of the opportunity to receive tactile and emotional stimulation, which is essential for central nervous system maturity and the development of motor and cognitive functions.

Infant development will occur effectively if it receives stimulation that simultaneously addresses sensory, emotional, and motor aspects. Without it, the infant will still develop, but not optimally. Early stimulation, including through massage, contributes significantly to the formation of neural pathways, the ability to regulate emotions, and fine and gross motor skills (Rakhmawati *et al.*, 2024); (Nousia, 2023). The absence of such intervention will cause the infant to miss a crucial developmental window that cannot be replicated.

Table 4. Differences in development between the intervention and control groups.

Characteristics	Massage (N=35)		Non-Massage (N=35)		P-value
	Mean	SD	Mean	SD	
Developmen	40.00	1400	31.00	1085	0.001

Mann-Whitney Information

Table 4 shows that in terms of development, infants in the treatment group also showed a significantly higher average developmental improvement in contrast with the baseline cohort, the treatment group exhibited an average ranking of 40.00 in the final assessment, whereas the baseline group demonstrated a lower mean score of 31.00, with a significance value of p = 0.001.

A notable variation in early childhood growth was observed among the categories receiving massage therapy and those not receiving massage therapy. The treatment group showed a significant increase in developmental scores across physical coordination abilities, precise hand movements,

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verbal communication capabilities, and interpersonal competencies responsiveness. In contrast, the control group showed stagnation, and in some cases, a trend towards a decrease in developmental scores based on the results of the Pre-Screening Development Questionnaire (KPSP).

This difference was not only quantitative but also qualitatively significant. Infant massage is more than just a touch technique, but also a form of profound neurological stimulation. The stimulation of gentle pressure, skin-to-skin contact, rhythmic movements, and emotional closeness during massage can increase blood flow to the brain, accelerate synapse formation, and strengthen connections between neurons, which are crucial for infant sensory and motor development.

Between the ages of 0–6 months, a baby's brain development relies heavily on consistent and appropriate external stimulation. When babies are stimulated through regular massage, they not only learn to respond physically but also lay the foundation for future social and emotional skills. This is a fundamental difference from the group that did not receive a massage, where development proceeded naturally without the support of active external stimulation.

These findings align with research (Nousia, 2023), which states that infant massage can accelerate neurological maturity, increase serotonin and dopamine levels, which influence mood and cognitive abilities, and strengthen the emotional bond between mother and child. With massage, children not only develop faster but also grow up in a more responsive and caring environment. In the treatment group, babies were immersed in a stimulating ecosystem, receiving consistent touch, attention, and emotional closeness. Meanwhile, in the control group, although basic needs were met, the lack of interaction deprived babies of opportunities to develop their potential from an early age.

The advantages of providing massage interventions involving mothers to provide massage independently at home. This study not only assesses the effectiveness of the intervention but also encourages family involvement and strengthens mother-child bonding. Furthermore, infant massage as an intervention is simple, safe, inexpensive, and easy to practice,

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so the research results have high applicability potential in the wider community.

A limitation of this study is that not all external variables were controlled. Factors such as nutritional intake, sleep patterns, environmental stimulation, and breast milk quality were not controlled, which could influence infant development outcomes.

CONCLUSION

Based on the research results, it can be concluded that infant massage performed for 15 minutes, twice a week for four weeks, has been proven effective in improving the development of 3-month-old infants. There was a significant increase in developmental scores in the treatment group compared to the control group, as assessed using the Developmental Pre-Screening Questionnaire (KPSP). This intervention not only provides sensory and motor stimulation but also deepens the affective link between a mother and her child, which is a factor supporting optimal growth and development.

Given these results, it is recommended that infant massage be widely implemented in maternal and child health service programs, particularly as part of family-based early childhood stimulation. Health workers at community health centers (Puskesmas) and integrated health posts (Posyandu) can be involved in training and educating mothers on appropriate massage techniques.

This study is limited by its quasi-experimental design and the use of purposive sampling, which may introduce selection bias and limit the generalizability of the findings. The relatively short intervention period and the lack of control over potential confounding variables, such as nutritional status, sleep patterns, and environmental stimulation, may have influenced infant developmental outcomes.

Future research is recommended to employ randomized experimental designs with larger sample sizes, longer intervention and follow-up periods, and better control of confounding variables. The use of more comprehensive developmental assessment instruments and longitudinal evaluations is also encouraged to strengthen the evidence on the effectiveness of infant massage.

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