Panacea Journal of Nursing and Health Studies
Vol. 1, No. 1 (2026)
https://journal.ziacenter.org/index.php/panacea

Motor Development Before and After Baby Massage Among Children Aged 0–36 Months in South Jakarta, Indonesia

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ABSTRACT
Motor development is central to the physical abilities that emerge in early childhood, making developmental assessment and appropriate stimulation important aspects of child health care. Although infant massage has been investigated in various populations, evidence concerning changes in motor-development classifications among children across a broad age range in community settings remains limited. This study examined motor-development classifications before and after baby massage among 30 children aged 0–36 months in Jati Padang, Pasar Minggu, South Jakarta, Indonesia. A pre-experimental, one-group pretest–posttest design was employed, with motor development assessed using the Denver Developmental Screening Test (DDST). Participants received four massage sessions over two weeks. Descriptive statistics were used to summarize developmental classifications, and the Wilcoxon signed-rank test was applied to compare pretest and posttest assessments. Before the intervention, 24 participants (80.0%) were classified as having questionable development and six (20.0%) as requiring referral. After the intervention, 19 participants (63.3%) were classified as having appropriate development, while 11 (36.7%) remained in the questionable category. The pretest–posttest difference was statistically significant ($Z = -4.291$, $p < .001$). These findings provide context-specific evidence of changes in DDST-based motor-development classifications following a brief massage intervention. However, the absence of a control group, small sample, and broad age range preclude definitive causal conclusions. Further controlled research with age-specific analyses and standardized protocols is needed to clarify the role of baby massage in early developmental stimulation.

ARTICLE HISTORY
Received, 12 July 2026
Accepted, 28 October 2026

KEYWORDS:
Baby Massage; Motor Development; Denver Developmental Screening Test; Early Childhood; Pretest–Posttest Study

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1. Introduction

Early childhood is a period of rapid development during which biological maturation and environmental experiences interact to shape emerging physical, cognitive, and behavioral abilities. Motor development is a particularly important component of this process because it reflects infants' developing capacity to control posture, coordinate movement, and interact with their surroundings. The early years are also a period in which developmental support may be especially relevant. Research on early intervention emphasizes the importance of recognizing developmental needs and providing appropriate stimulation during infancy (Cioni et al., 2016; Ismail et al., 2017; Morgan et al., 2021). However, developmental trajectories vary among children, and early motor development

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should not be understood as a uniform process. The assessment of motor abilities and the identification of potential developmental concerns therefore remain important elements of infant care (Heineman & Hadders-Algra, 2008; Hadders-Algra & Heineman, 2021).

Within this context, infant massage has received attention as a tactile intervention that can be incorporated into caregiving and maternal–child health practices. Massage involves structured touch and may be delivered by health professionals or by parents following appropriate guidance. Previous research has investigated massage in relation to infant growth, sleep, parent–infant interaction, and developmental outcomes. Studies have examined tactile and kinesthetic stimulation among preterm infants (Field et al., 1986; Mathai et al., 2001), while other work has considered massage and touch interventions in relation to infant physical development and caregiving experiences (Kulkarni et al., 2010; Field et al., 2010). Reviews have also discussed the evidence for massage in neonatal and infant care, including its potential benefits and the need to interpret findings in relation to the population and outcome examined (Field, 2014; Lu et al., 2020). This literature provides a rationale for examining massage as a form of early stimulation, while also indicating that its effects should be evaluated against specific developmental outcomes rather than assumed to be universal.

Despite the growing interest in infant massage, the evidence base encompasses interventions, populations, and outcomes that are not directly interchangeable. Research involving preterm or low-birth-weight infants, for example, addresses developmental and clinical circumstances that differ from those of healthy, full-term infants living in community settings. Studies of massage in preterm populations have investigated growth and other clinical outcomes, including the effects of tactile–kinesthetic stimulation (Abdallah et al., 2013; Abd Elmoneim et al., 2020). Systematic reviews have likewise focused on massage for weight gain among preterm neonates, rather than on motor development in the general infant population (Lu et al., 2020). Although this work contributes to understanding massage in early life, its findings cannot automatically be generalized to infants across a broad age range or to motor-development classifications assessed in community settings. Differences in participant characteristics, intervention protocols, duration, and outcome measures complicate direct comparison across studies.

A further challenge is that infant massage studies frequently examine outcomes other than motor development. Research has addressed infant weight, sleep, physiological responses, maternal attachment, and parent–infant interaction (Agarwal et al., 2000; Ferber et al., 2002; Gurol & Polat, 2012). These outcomes are relevant to infant and family well-being, but they do not directly establish whether massage is associated with measurable changes in motor development. Even when developmental outcomes are included, studies may differ in the age of participants and the assessment instruments used. Such variation makes it difficult to determine how consistently the reported findings apply across settings.

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Consequently, focused investigations of motor development are needed, particularly those that clearly identify the population, describe the intervention, and use a consistent assessment approach before and after the intervention.

Several previous studies have addressed this issue more directly. Inal and Yildiz (2012) investigated the relationship between baby massage and mental–motor development in healthy full-term infants. Kusumastuti et al. (2016) examined massage in relation to sleep quality and motor development among infants aged 3–6 months. Research has also considered massage interventions for infants with developmental delay, extending the literature to populations requiring additional developmental support (Lu et al., 2019). In addition, studies of massage and motion training have explored infant growth and development as related outcomes (Jing et al., 2007). Collectively, these studies indicate that motor development has been investigated in several contexts, but the diversity of populations and intervention approaches highlights the importance of further research in specific community settings. They also support the need to distinguish evidence concerning general development from evidence directly addressing motor outcomes.

The present study addresses a context-specific gap by examining motor-development classifications before and after baby massage among 30 infants aged 0–36 months in Jati Padang, Pasar Minggu, South Jakarta. The manuscript's literature review identifies Indonesian studies of massage and gross motor development among infants of different ages, including infants aged 3–6 months, 0–12 months, and 6–12 months (Syam & Ikawati, 2021; Kurniarum & Putri, 2022; Nidaul Khoiroh, 2023; Lukas, 2025). Other studies have considered motor development alongside broader infant outcomes (Nurseha, 2022; Yanti et al., 2022). However, the current study differs in its inclusion of infants across the 0–36-month age range and its use of a one-group pretest–posttest design with the Denver Developmental Screening Test (DDST). Its contribution is therefore a local assessment of developmental classifications surrounding a short massage intervention, rather than a definitive test of causal efficacy. The absence of a control group and the broad age range must be considered when interpreting the findings.

Accordingly, this study aimed to examine changes in the motor-development classifications of infants aged 0–36 months following baby massage in Jati Padang, Pasar Minggu, South Jakarta. It addressed three research questions: (1) What were the infants' motor-development classifications before the massage intervention? (2) What were their motor-development classifications after the intervention? and (3) Was there a statistically significant difference between the pretest and posttest assessments? By addressing these questions, the study provides context-specific evidence on the observed changes associated with baby massage and may inform further research using controlled designs, clearly specified massage protocols, and age-appropriate developmental assessment.

2. Methodology

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Research Design and Setting

We used a pre-experimental, one-group pretest–posttest design to examine changes in motor development following a baby-massage intervention. The design involved assessing participants before the intervention, administering the intervention, and reassessing the same participants after its completion. This approach enabled a within-group comparison of motor-development assessments before and after baby massage.

The study took place in Jati Padang, Pasar Minggu, South Jakarta, Indonesia. The study population comprised 30 infants aged 0–36 months. The research focused on motor development as the outcome variable and baby massage as the intervention. No separate control group was included in the study design. Consequently, the findings represent changes observed within the participating group over the study period and should be interpreted in light of the limitations inherent in a one-group pretest–posttest design.

Participants and Sampling

The study involved 30 infants aged between 0 and 36 months who were included in the research conducted in Jati Padang, Pasar Minggu, South Jakarta. The manuscript identifies these 30 infants as the study population. However, it does not clearly distinguish the target population from the participants recruited for the study or specify the sampling technique used.

The participant recruitment process, eligibility criteria, and reasons for excluding potential participants were not reported in the original manuscript. These details should be clarified to establish how the study sample was obtained and to assess the applicability of the findings to other infant populations. The revised manuscript should specify the inclusion and exclusion criteria, the recruitment method, the number of infants approached, and whether all 30 participants completed both assessments and received the full intervention.

The age range of 0–36 months encompasses infants at substantially different stages of development. Accordingly, the final manuscript should also clarify how participants' ages were determined and whether age-specific developmental expectations were considered when interpreting their DDST results.

Intervention Procedure

The intervention comprised four baby-massage sessions over two weeks. Before the intervention, each participating infant underwent an initial motor-development assessment using the Denver Developmental Screening Test (DDST). This assessment served as the pretest and established the developmental classification recorded before the intervention.

After the pretest, the infants received the baby-massage intervention. The manuscript indicates that the intervention was delivered four times within two weeks. The Discussion section further describes the intervention as being conducted twice weekly over the same period. These descriptions are consistent with four sessions in total, although the precise

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scheduling and interval between sessions should be confirmed.

After the four sessions, motor development was reassessed using the DDST. This second assessment constituted the posttest and provided the outcome data for comparison with the baseline assessment.

For reproducibility, the intervention description should be expanded to include the massage protocol used in the study. Specifically, the authors should report the person who administered the massage, their training or qualifications, the body areas and massage techniques involved, the duration of each session, the setting in which the intervention was delivered, and whether the sessions followed a standardized procedure. The original manuscript does not provide these details; they should be added only after verification against the actual study protocol and records.

Outcome Measure and Data Collection

Motor development was assessed using the Denver Developmental Screening Test (DDST), as reported in the original manuscript. The instrument was administered before and after the intervention to evaluate the infants' developmental status at the two assessment points. The resulting assessments were used to classify motor development and to examine differences between the pretest and posttest results.

The manuscript reports developmental classifications including "questionable," "requiring referral," "appropriate," and "deviant." However, it does not identify the specific DDST version, describe the motor items assessed, or explain the scoring and classification procedures. The authors should verify the official terminology used by the instrument and ensure that the categories reported before and after the intervention are consistent with the assessment protocol. The procedures used to administer the DDST, the identity and qualifications of the assessor, and any measures taken to maintain consistency between assessments should also be documented.

After data collection, the data were processed through editing, scoring, coding, and tabulation. Editing was used to review the collected data, while scoring and coding organized the assessment results for analysis. The processed data were subsequently summarized in tables to facilitate descriptive and inferential interpretation.

Statistical Analysis

The data were analyzed using univariate and bivariate procedures. Univariate analysis was used to describe the study variables through frequency distributions. In particular, the pretest and posttest motor-development classifications were summarized using frequencies and percentages. This approach provided a descriptive overview of the participants' developmental classifications at each assessment point.

Bivariate analysis was conducted to examine the difference between motor-development assessments before and after the intervention. The manuscript identifies the

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paired-samples t test as the planned parametric procedure when the data met the normality assumption and the Wilcoxon signed-rank test as the nonparametric alternative when the data were not normally distributed. This analytical approach is consistent with the stated objective of comparing measurements obtained from the same participants at two time points. The use of univariate and bivariate analyses follows the general analytical framework described by Sahir (2022).

The manuscript reports that the normality-test results for both pretest and posttest data were statistically significant at $p < .05$. On this basis, the Wilcoxon signed-rank test was selected. The reported Wilcoxon result was $Z = -4.291$, with the software output recorded as $p = .000$. Because a reported value of .000 reflects rounding, it should be presented as $p < .001$, provided this is consistent with the original statistical output. The specific normality test and statistical software were not identified in the manuscript and should be confirmed before submission.

3. Results and Discussion

Motor Development Before and After Baby Massage

Before the intervention, none of the 30 infants was classified as having development within the "appropriate" category. As shown in Table 1, 24 infants (80.0%) were classified as "questionable," while 6 (20.0%) were classified as requiring referral.

Table 1. Motor Development Before Baby Massage (n = 30)

Motor development classification	**n**	**%**
Questionable	24	80.0
Requiring referral	6	20.0
Total	**30**	**100.0**

Following the intervention, 19 infants (63.3%) were classified as having "appropriate" development, while 11 (36.7%) remained in the "questionable" category. No infants were recorded in the "deviant" category. These findings are summarized in Table 2.

Table 2. Motor Development After Baby Massage (n = 30)

Motor development classification	**n**	**%**
Appropriate	19	63.3
Questionable	11	36.7
Deviant	0	0.0
Total	**30**	**100.0**

Normality Assessment and Paired Analysis

The reported normality-test results for the pretest and posttest motor-development data were both $p = 0.000$ in **the** original analysis output. These values are reported as $p < .001$ in Table 3. Based on the reported results, the study used the Wilcoxon signed-rank test

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for the pretest–posttest comparison. The name of the normality test should be specified in the final manuscript after verification against the statistical output.

Table 3. Normality-Test Results for Motor Development Before and After Baby Massage

Assessment	n	Reported *p* value
Before intervention	30	< .001
After intervention	30	< .001

The Wilcoxon signed-rank test yielded a reported Z value of −4.291 and a significance value of 0.000, reported as p < .001. The test indicated a statistically significant difference between the pretest and posttest motor-development assessments. The reported test results are presented in Table 4.

Table 4. Wilcoxon Signed-Rank Test Comparing Motor Development Before and After Baby Massage

Comparison	*Z*	*p*
Before versus after baby massage	−4.291	< .001

Discussion

Motor-development classifications differed significantly before and after the four-session baby-massage intervention. This pattern is consistent with the study's objective of examining whether infants' developmental classifications changed over the two-week observation period. Before the intervention, all 30 participants were classified as either "questionable" or "requiring referral"; following the intervention, 19 were classified as "appropriate," while 11 remained "questionable." The Wilcoxon signed-rank test also identified a statistically significant pre–post difference (Z = −4.291, p < .001). Taken together, these findings suggest that the developmental assessments recorded at the end of the intervention period differed from those obtained at baseline. Nevertheless, the results should be interpreted as evidence of change over time within the study group rather than as conclusive evidence that massage alone produced the observed improvement. The one-group pretest–posttest design does not allow the effects of the intervention to be separated from other influences on development during the same period.

The baseline findings provide important context for interpreting this change. The fact that none of the participants was initially classified as having "appropriate" development, while 80% were categorized as "questionable" and 20% as "requiring referral," indicates that developmental concerns were common in this particular sample. These classifications warrant attention because early identification of developmental difficulties can help guide decisions about further assessment and support. However, the findings do not establish that the infants had received insufficient stimulation before the study, nor do they demonstrate that limited parental involvement was responsible for their baseline classifications. Such explanations were proposed in the original manuscript but were not directly examined

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through measures of caregiving practices, opportunities for movement, or the home environment. Developmental status may reflect multiple interacting influences, and the present data do not permit their relative contributions to be determined. The baseline distribution should therefore be understood as a characteristic of the participating group, not as evidence of a specific cause of developmental difficulty.

The post-intervention distribution suggests that the observed developmental classifications shifted toward the "appropriate" category during the study period. This finding is broadly consistent with research investigating massage in relation to infant development, although the degree of comparability varies across studies. Inal and Yildiz (2012), for example, examined the relationship between baby massage and mental–motor development in healthy full-term infants. Kusumastuti et al. (2016), as discussed in the manuscript's literature review, investigated massage in relation to motor development among infants aged 3–6 months. Indonesian studies have also considered gross motor development in relation to baby massage among infants aged 0–12 months and within narrower age groups (Kurniarum & Putri, 2022; Syam & Ikawati, 2021; Yanti et al., 2022). The direction of the present findings is compatible with this body of work, which has examined massage as a form of early developmental stimulation. However, differences in participant age, study design, intervention procedures, and outcome assessment mean that the results should not be treated as direct replications of those studies.

The wider massage literature also supports a cautious interpretation. Field et al. (1986) and Mathai et al. (2001) investigated tactile–kinesthetic stimulation in preterm infants, while Field et al. (2010) reviewed research on massage therapy in preterm populations. These studies provide a background for considering touch and movement-based stimulation in early life, but preterm infants differ from community-based infants in their clinical circumstances and developmental risks. Similarly, Abdallah et al. (2013) and Abd Elmoneim et al. (2020) focused on massage-related outcomes in preterm infants, including growth and body composition. Their findings cannot be directly generalized to the present sample, which included children across the 0–36-month age range and did not report a separate analysis by gestational history or clinical status. The systematic review by Priyadarshi et al. (2022), which examined whole-body massage in healthy term newborns, further illustrates the importance of distinguishing between outcomes: the review found that evidence for some short-term outcomes was uncertain and that the effects on neurodevelopment were also uncertain. Thus, although the present findings add to the literature on massage and developmental assessment, they do not resolve broader questions about the consistency or magnitude of its effects.

One possible explanation for the observed pattern is that massage provides structured tactile stimulation within a caregiving interaction. Touch and gentle physical handling may offer sensory experiences that accompany opportunities for infants to become

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aware of their bodies and movements. This interpretation is compatible with the broader literature on tactile–kinesthetic stimulation and early intervention (Field et al., 1986; Mathai et al., 2001). However, the current study did not measure neural activity, muscle function, sensory processing, or movement coordination as mechanisms. It therefore cannot establish the physiological pathway through which massage might be associated with changes in developmental performance. Moreover, massage is delivered within a social context: the intervention may involve caregiver attention, physical contact, and repeated interaction. Research has examined infant massage in relation to parent–infant attachment and sleep-related outcomes (Ferber et al., 2002; Gurol & Polat, 2012), suggesting that massage may be part of a broader caregiving experience. In the present study, however, these outcomes were not assessed, and it is not possible to determine whether changes in interaction or caregiving contributed to the observed developmental classifications.

The intervention's short duration is another important consideration. The infants received four massage sessions over two weeks, a relatively brief period in which to examine developmental change across such a wide age range. Motor development is a dynamic process, and the skills expected of a young infant differ substantially from those expected of a child approaching three years of age. Consequently, age is central to interpreting developmental assessment results. The study does not report age-stratified findings, making it impossible to determine whether the observed pattern was similar among younger infants and older children. Nor does the reported analysis establish whether the amount of change differed by initial developmental classification. The broad age range therefore limits the specificity of the conclusions and complicates comparisons with studies focused on narrower groups, such as infants aged 3–6 months (Kusumastuti et al., 2016; Syam & Ikawati, 2021) or 0–12 months (Kurniarum & Putri, 2022).

The use of the Denver Developmental Screening Test (DDST) provides a structured basis for assessing developmental status before and after the intervention. Nevertheless, the manuscript does not specify the DDST version, the precise scoring procedure, the assessor's qualifications, or whether the same assessor conducted both assessments. These details are important because the interpretation of screening classifications depends on consistent administration and appropriate application of the instrument. The terminology used in the manuscript also requires verification. The pretest categories are reported as "questionable" and "requiring referral," whereas the posttest categories include "appropriate" and "deviant." The authors should confirm that these labels correspond to the instrument and scoring procedure actually used, and explain how classifications were derived. Without this clarification, it is difficult to determine whether the apparent shift reflects comparable categories at both time points. This issue is particularly important when the outcome is reported as categorical developmental status rather than as scores for specific motor skills.

The statistically significant Wilcoxon result supports the conclusion that the paired

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assessments differed, but statistical significance should not be equated with clinical or developmental significance. The reported p value indicates that the observed difference would be unlikely under the test's null hypothesis, assuming the analysis was conducted appropriately. It does not quantify the magnitude of change, establish that the change was meaningful for each child, or identify its cause. Furthermore, the marginal frequencies presented in the tables do not show each participant's transition between categories. Although 19 children were classified as "appropriate" after the intervention, the available tables do not reveal precisely how many moved from each baseline category to each posttest category. A paired transition table would provide a clearer account of individual changes. Future reporting should also include the relevant test statistics and an effect-size estimate, where appropriate, to help readers assess the magnitude of the observed difference.

This study contributes context-specific evidence on developmental classifications before and after a brief baby-massage intervention in Jati Padang, South Jakarta. Its inclusion of participants aged 0–36 months extends beyond the narrower age groups examined in several studies cited in the manuscript. At the same time, this breadth should be treated as an exploratory feature rather than evidence that the findings apply uniformly across the entire age range. The results may encourage further consideration of massage as one component of infant-care and developmental-stimulation practices, but they do not justify using massage as a substitute for developmental screening, referral, or other indicated support. In particular, children whose assessments indicate a need for further evaluation should receive appropriate follow-up rather than relying on massage alone.

Several methodological improvements would strengthen future research. A controlled study with a clearly specified and reproducible massage protocol would help distinguish intervention-related change from maturation, concurrent stimulation, and other time-related influences. Recruitment procedures, eligibility criteria, participant characteristics, session duration, massage provider, and adherence should be reported transparently. Age-stratified analyses and consistent use of an explicitly identified developmental assessment would also improve interpretability. Where feasible, follow-up assessments could establish whether any observed changes persist beyond the immediate post-intervention period. In conclusion, DDST-based motor-development classifications differed significantly after four massage sessions over two weeks. The pattern is consistent with the possibility that massage may form part of early developmental stimulation, but the study design and reporting limitations mean that causal efficacy, the mechanisms involved, and the durability of the observed changes remain uncertain.

4. Conclusion

This study examined changes in motor-development classifications among 30 children aged 0–36 months after a brief baby-massage intervention in Jati Padang, Pasar

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Minggu, South Jakarta. Before the intervention, 24 participants (80.0%) were classified as having questionable development, while six (20.0%) were classified as requiring referral. Following four massage sessions over two weeks, 19 participants (63.3%) were classified as having appropriate development, whereas 11 (36.7%) remained in the questionable category. The Wilcoxon signed-rank test indicated a statistically significant difference between the pretest and posttest assessments ($Z = -4.291$, $p < .001$). These findings demonstrate a change in DDST-based motor-development classifications over the study period. However, given the one-group pretest–posttest design, the observed difference cannot be attributed exclusively to baby massage. The findings should therefore be interpreted as preliminary, context-specific evidence of developmental change following the intervention rather than definitive evidence of its causal effectiveness.

Several limitations should be considered when interpreting these findings. The absence of a control group prevents the effects of massage from being distinguished from maturation, concurrent developmental stimulation, and other influences. Furthermore, the relatively small sample from a single community and the broad age range of 0–36 months limit the generalizability and age-specific interpretation of the results. The study also provides limited information about the massage protocol and the administration and classification procedures of the DDST. Future research should employ controlled study designs, recruit larger and more diverse samples, conduct age-stratified analyses, standardize and report intervention procedures, and include follow-up assessments to examine the persistence of observed changes. Consistent reporting of developmental classifications and individual pretest–posttest transitions would further strengthen the interpretation of outcomes. Despite these limitations, this study contributes community-based evidence concerning motor-development classifications before and after baby massage among children across the first three years of life. The findings support further investigation of baby massage as a potential component of early developmental stimulation, while emphasizing that it should not replace routine developmental screening, professional assessment, or referral when developmental concerns are identified.

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