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The effect of infant massage on mother–infant bonding among infants aged 6–12 months: A quasi-experimental study

Ririn Indriani[1], Finta Isti Kundarti[1]

[1]Department of Midwifery, Poltekkes Kemenkes Malang, Kediri, East Java, Indonesia

Corresponding Author: Ririn Indriani, ririnindrianimiori79@gmail.com

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Abstract:
Mother–infant bonding underpins infants' emotional, cognitive, and social development, yet evidence on infant massage beyond the neonatal period remains limited. This study examined the effect of mother-delivered infant massage on mother–infant bonding among infants aged 6–12 months. A quasi-experimental pretest–posttest design with a nonequivalent control group was conducted from January to November 2025 at five Posyandu (integrated community health posts) in Kediri, Indonesia. Sixty purposively recruited mother–infant dyads were assigned to an intervention group (n = 30) or a control group (n = 30). Intervention mothers received standardized massage training and massaged their infants for 30 minutes twice weekly for four weeks, supported by eight monitoring visits; control mothers received routine care. Bonding was measured with the Maternal–Infant Bonding Scale (MIBS) and analyzed using paired and independent t-tests. Bonding scores in the intervention group increased from 58.43 ± 6.12 to 68.70 ± 5.48 ($p < 0.001$), whereas the control group showed no significant change (57.96 ± 5.89 to 59.10 ± 5.76; $p = 0.218$). Posttest scores differed significantly between groups (mean difference 9.60; 95% CI 6.69–12.51; $d = 1.71$). Mother-delivered infant massage strengthened mother–infant bonding and is a feasible, low-cost addition to community-based maternal and child health services.

Keywords:
attachment; community health services; infant massage; mother–infant bonding; nursing

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INTRODUCTION

The first year of life is a period of rapid brain growth in which the quality of early caregiving shapes later emotional, cognitive, and social outcomes. The nurturing care framework identifies responsive caregiving as a core component of early childhood development and calls for interventions delivered through routine health services (Britto et al., 2017; Vaivada et al., 2017). Within this framework, mother–infant bonding, the mother's emotional tie to her infant, expressed through warmth, closeness, and the wish to protect and nurture, forms the relational foundation on which secure attachment develops (Bianciardi et al., 2023; Ettenberger et al., 2021). Stronger maternal bonding predicts better social-emotional and behavioral development in infancy, whereas

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weak bonding is linked to less sensitive caregiving and a higher risk of later emotional difficulties (Le Bas et al., 2022).

Touch is one of the earliest and most powerful channels through which this relationship is built. Slow, gentle stroking activates C-tactile afferents in the skin, a pathway associated with oxytocin release and with the pleasant, rewarding quality of affiliative touch (Walker et al., 2017). Oxytocin, in turn, supports maternal sensitivity and the behavioral synchrony between mother and infant that underpins human attachment (Feldman, 2017). Affectionate caregiver touch also helps infants regulate arousal and attend to social partners, making shared, well-timed interaction more likely (Carozza & Leong, 2021). Evidence from skin-to-skin contact shows that structured touch early in life can produce both short- and long-term benefits for mothers and their children (Bigelow & Power, 2020).

Infant massage offers a simple, structured way to bring these benefits into daily caregiving. Reviews report that massage can improve infant sleep, reduce crying and stress hormones, and support growth and development (Bennett et al., 2013; Field, 2019; Mrljak et al., 2022). For mothers, mother-led massage has been associated with fewer depressive symptoms, better mother–infant interaction, and stronger attachment (Geary et al., 2023; Zhang et al., 2023). In a quasi-experimental study in Türkiye, mothers who massaged their newborns daily reported higher maternal attachment than controls (Gürol & Polat, 2012), and salivary oxytocin increased after massage in mother–infant pairs with normal bonding (Moussa et al., 2021). Qualitative studies indicate that mothers experience massage as a calm, shared moment that helps them feel close to and confident with their babies (Danielsson et al., 2024; Midtsund et al., 2019).

Beyond its potential physiological effects, infant massage may strengthen bonding by creating repeated opportunities for reciprocal interaction between mothers and infants. During massage, mothers can observe their infants' facial expressions, body movements, vocalizations, and responses to touch, allowing them to adjust their behavior according to the infants' cues. This process may promote maternal sensitivity and strengthen the coordination of emotional and behavioral responses between mother and infant, which are central to biobehavioral synchrony (Feldman, 2017). Such interactions are particularly relevant during the latter half of infancy, when infants increasingly communicate their preferences and responses through more differentiated social behaviors. Thus, infant massage may serve not only as a tactile stimulation technique but also as an opportunity to develop responsive caregiving and strengthen the emotional relationship.

The involvement of mothers as the primary providers of infant massage may also be important for translating a structured intervention into sustainable caregiving practices. Unlike massage delivered exclusively by health professionals, mother-delivered massage allows affectionate touch and responsive interaction to become part of everyday mother–infant routines. Repeated opportunities for interaction may help mothers become more familiar with their infants' behavioral cues and develop greater confidence in responding to their needs. This approach is consistent with the nurturing care framework, which emphasizes the role of parents and other primary caregivers in providing responsive and developmentally supportive care (Britto et al., 2017; Vaivada et al., 2017). Accordingly, evaluating a mother-delivered program in community settings may provide insights into both its potential contribution to bonding and its feasibility within routine family caregiving.

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Despite this promising evidence, important gaps remain. Most trials have focused on newborns, preterm infants, or infants younger than six months, often in hospital settings (Bennett et al., 2013; Zhang et al., 2023). Much less is known about infants aged 6–12 months, a stage at which infants become more mobile, show clear preferences for familiar caregivers, and consolidate their first attachment relationships. Evidence from Indonesia is also limited and mixed. A recent community study in Central Java reported improved attachment but no significant change in bonding after one month of massage in a single-group design (Nugraheni et al., 2024), while a hospital-based trial focused on maternal self-efficacy among mothers of preterm infants (Pramitha et al., 2026). Controlled studies using community platforms such as the Posyandu (integrated community health post), where nurses and midwives meet mothers every month, remain scarce. How such programs are delivered also matters: the caring behavior of health workers and the quality of their interpersonal relationships with clients shape whether families engage with and sustain new practices (Afandi et al., 2025; Ardiana et al., 2022).

Therefore, this study aimed to examine the effect of a mother-delivered infant massage program on mother–infant bonding among infants aged 6–12 months in community health settings in Kediri, Indonesia. We hypothesized that mothers in the intervention group would show a greater increase in bonding scores than mothers receiving routine care.

METHOD

This study used a quasi-experimental pretest–posttest design with a nonequivalent control group. Reporting follows the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) statement (Des Jarlais et al., 2004). The study was conducted from January to November 2025 in five Posyandu: Seroja, Menur, Melati, Teratai, and Dahlia, located in the working areas of the Sukorame Public Health Center and the South Kediri Public Health Center, Kediri City, East Java, Indonesia. Posyandu are monthly community-based services where mothers bring their children for growth monitoring, immunization, and health education. The target population was mothers with infants aged 6–12 months who attended these Posyandu, and participants were recruited by purposive sampling. Inclusion criteria were: (1) an infant aged 6–12 months in good general health; (2) the mother was the infant's primary caregiver; and (3) the mother was willing to take part for the whole study period. Infants with conditions in which massage is contraindicated, such as fever, skin infection, or recent injury, were not included. A total of 60 mother–infant dyads took part and were assigned to the intervention group (n = 30) or the control group (n = 30).

The intervention had three components. First, mothers in the intervention group attended a training session in which the research team demonstrated a standardized full-body infant massage sequence (legs, abdomen, chest, arms, face, and back) on a demonstration doll, after which mothers practiced the techniques. Second, during the first home visit, each mother practiced the massage directly on her own infant under researcher supervision and received individual feedback. Third, mothers were asked to massage their infants at home for about 30 minutes, twice weekly, for four consecutive weeks. Mothers were taught to use gentle, rhythmic strokes, maintain eye contact, and talk to the infant during the massage, and to stop if the infant showed signs of distress. The researchers made eight monitoring visits (twice weekly) to check technique, support adherence,

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and record behavioral responses. Mothers in the control group continued to receive routine Posyandu services without infant massage training.

Mother–infant bonding was measured with the Maternal–Infant Bonding Scale (MIBS), a self-report questionnaire completed by the mother that assesses her emotional feelings toward the infant (Taylor et al., 2005). The Indonesian version was used, and total scores were calculated, with higher scores indicating stronger bonding. The MIBS was administered in both groups before the training session (pretest) and at the end of the four-week intervention (posttest).

During the monitoring visits, the researchers recorded field notes on predefined indicators of mother–infant interaction: maternal emotional warmth, eye contact, maternal responsiveness, infant calmness, infant responsiveness, maternal caregiving confidence, and infant sleep and feeding patterns as reported by the mother. These notes were summarized descriptively to complement the questionnaire data.

Data are presented as means and standard deviations (SD). The normality of score distributions were checked before parametric testing. Paired t-tests were used to compare pretest and posttest scores within each group, and independent t-tests were used to compare the groups at pretest (baseline equivalence) and at posttest. Mean differences are reported with 95% confidence intervals (CI). Effect sizes were expressed as Cohen's d, calculated as the mean difference divided by the pooled SD for between-group comparisons and by the average of the pretest and posttest SDs for within-group change (dav); values of 0.2, 0.5, and 0.8 were interpreted as small, medium, and large, respectively (Lakens, 2013). Statistical significance was set at $p < 0.05$. All mothers received verbal and written information about the study and gave written informed consent for themselves and their infants. Participation was voluntary, and mothers could withdraw at any time without affecting their access to health services. Data were anonymized and kept confidential. Infant safety was prioritized throughout: massage was postponed when an infant was unwell, and mothers were instructed to stop if the infant cried persistently or showed discomfort.

RESULTS

Data from all 60 mother–infant dyads (30 per group) were included in the analysis.

Table 1. Comparison of Maternal–Infant Bonding Scores Before and After Infant Massage Intervention

Group	Measurement	Mean ± SD	Mean Difference	p-value
Intervention Group (n = 30)	Pretest	58.43 ± 6.12	10.27	<0.001
	Posttest	68.70 ± 5.48		
Control Group (n = 30)	Pretest	57.96 ± 5.89	1.14	0.218
	Posttest	59.10 ± 5.76		

As shown in Table 1, the mean bonding score in the intervention group increased by 10.27 points, from 58.43 ± 6.12 at pretest to 68.70 ± 5.48 at posttest ($p < 0.001$). In contrast, the control group showed only a small, non-significant increase of 1.14 points, from 57.96 ± 5.89 to 59.10 ± 5.76 ($p = 0.218$).

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Table 2. Comparison of Posttest Maternal–Infant Bonding Scores Between Intervention and Control Groups

Variable	Intervention Group (n = 30)	Control Group (n = 30)	Mean Difference	p-value
Posttest Bonding Score	68.70 ± 5.48	59.10 ± 5.76	9.60	<0.001

At posttest, mothers in the intervention group had significantly higher bonding scores than mothers in the control group, with a mean difference of 9.60 points ($p < 0.001$) (Table 2).

Table 3. Baseline Equivalence, Between-Group Differences, and Effect Sizes of Maternal–Infant Bonding Scores

Comparison	Mean Difference	95% CI	t	p-value	Effect Size (d)
Pretest: intervention vs control	0.47	−2.63 to 3.57	0.30	0.763	0.08 (negligible)
Posttest: intervention vs control	9.60	6.69 to 12.51	6.61	<0.001	1.71 (large)
Pre–post change: intervention	10.27	–	–	<0.001	1.77[a] (large)
Pre–post change: control	1.14	–	–	0.218	0.20[a] (small)

Note. Between-group comparisons used independent t-tests (df = 58); d = mean difference/pooled SD. Within-group changes were tested with paired t-tests; [a]dav = mean change/average of pretest and posttest SDs (Lakens, 2013). CI = confidence interval.

Table 3 shows that the two groups had similar bonding scores at baseline (mean difference 0.47; 95% CI −2.63 to 3.57; $p = 0.763$; $d = 0.08$). After four weeks, the between-group difference was large (mean difference 9.60; 95% CI 6.69 to 12.51; $d = 1.71$). The within-group effect was large in the intervention group (dav = 1.77) and small in the control group (dav = 0.20), suggesting that the improvement was attributable to the intervention rather than to normal developmental change alone.

Table 4. Observational Findings During the Infant Massage Intervention

Observed Indicators	Findings During Intervention
Maternal emotional warmth	Mothers demonstrated more affectionate touch and verbal interaction
Eye contact	Increased eye contact between mothers and infants was observed
Maternal responsiveness	Mothers became more sensitive to infant cues and behaviors
Infant calmness	Infants appeared more relaxed and less fussy
Infant responsiveness	Infants showed improved responsiveness during interaction
Caregiving confidence	Mothers reported greater confidence in caring for their infants
Sleep and feeding patterns	Several mothers reported improved infant sleep and feeding responsiveness

The observational findings (Table 4) were consistent with the questionnaire results. During the monitoring visits, mothers in the intervention group showed more affectionate touch, eye contact, and verbal interaction with their infants and became more sensitive to infant cues. Infants appeared calmer, less fussy, and more responsive during interaction. Several mothers also reported greater confidence in caring for their infants and noted improvements in their infants' sleep and feeding.

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DISCUSSION

This study found that a four-week, mother-delivered infant massage program significantly strengthened mother–infant bonding among infants aged 6–12 months. The two groups had similar bonding scores at baseline, yet after the intervention, mothers who massaged their infants scored almost ten points higher than mothers who received routine care, a large effect (d = 1.71). The observational data pointed in the same direction: mothers became warmer and more attentive, and infants became calmer and more responsive. Together, these results support infant massage as a practical way to strengthen the early mother–infant relationship beyond the neonatal period.

Our findings are consistent with earlier studies, most of which were conducted with younger infants. Gürol and Polat (2012) reported higher maternal attachment scores among Turkish mothers who massaged their newborns daily, and a systematic review by Mrljak et al. (2022) concluded that infant massage benefits parent–infant interaction and parental well-being. In preterm populations, a meta-analysis found that massage strengthened mother–infant attachment (Zhang et al., 2023), and a review of mother-led massage found better mother–infant interaction alongside fewer postnatal depressive symptoms (Geary et al., 2023). Qualitative studies describe how mothers experience massage as a calm, shared moment that helps them get to know their baby and feel emotionally connected (Danielsson et al., 2024; Midtsund et al., 2019). The present study extends this evidence to older infants and to a community setting in Indonesia.

Our results differ in part from those of Nugraheni et al. (2024), who found improved attachment but no significant change in bonding after one month of infant massage in Central Java. Several design differences may explain this. Their study used a single group without a control group, relied in part on remote reporting via a messaging application, and did not describe a standardized bonding instrument. In contrast, our intervention combined hands-on training, supervised practice with the mother's own infant, and eight monitoring visits. This level of support may have improved the quality and regularity of the massage and helped mothers turn a technique into a meaningful interaction. These differences suggest that the effect of infant massage depends not only on touch itself but also on how the program is taught and supported.

Several mechanisms may explain how massage strengthens bonding. Slow, gentle stroking stimulates C-tactile afferents, which are linked to oxytocin release and the pleasant feeling of affiliative touch (Walker et al., 2017). Oxytocin supports maternal sensitivity, reward, and the biobehavioral synchrony between mother and infant that is central to human attachment (Feldman, 2017). Moussa et al. (2021) found that salivary oxytocin increased in both mothers and infants after massage, but only in dyads with normal bonding. This suggests that massage works best when it builds on an existing, functioning relationship, and that mothers with disordered bonding may need additional psychosocial support. In our study, the rise in bonding scores may reflect a positive cycle: pleasant touch encourages closeness, and closeness encourages further affectionate touch.

An additional consideration is the role of maternal responsiveness in translating physical touch into meaningful bonding experiences. Infant massage provides opportunities for mothers to observe subtle behavioral cues, including changes in facial expressions, body movements, and vocalizations, as well as signs of comfort or discomfort. Responding appropriately to these signals may strengthen the reciprocal nature of mother–infant interaction, in which the infant's responses

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guide maternal behavior and reinforce emotional connection. This process is consistent with the concept of biobehavioral synchrony, in which maternal sensitivity and infant responses develop through repeated, coordinated interactions (Feldman, 2017). Therefore, the potential value of infant massage may extend beyond the tactile stimulation itself to the development of maternal sensitivity and more responsive caregiving.

Changes in the infant are likely to have contributed as well. Massage has been associated with lower stress hormones, better sleep, and less crying (Bennett et al., 2013; Field, 2019). A calmer, better-regulated infant is easier to read and more rewarding to interact with, which can increase the mother's sense of competence and warmth. Affectionate touch also helps infants orient to faces and voices, making well-timed, back-and-forth interaction more likely (Carozza & Leong, 2021). The calmer behavior, improved responsiveness, and reported improvements in sleep and feeding observed in our study align with this pathway. Bonding may therefore have improved through two linked routes: a direct effect on the mother's feelings and an indirect effect through a more settled and responsive infant.

The age group in this study deserves attention. Between 6 and 12 months, infants become more mobile and more selective in their social preferences, and daily care can become busier and more task-focused. A regular massage session provides protected time for face-to-face contact, eye contact, and talking, during which mothers can practice reading their infant's cues. Many mothers in our study also reported greater confidence in caring for their infants. This is consistent with a recent Indonesian trial in which infant massage improved maternal self-efficacy, including the ability to read infant behavior and signals (Pramitha et al., 2026). Because stronger maternal bonding predicts better social-emotional and behavioral development (Le Bas et al., 2022), supporting bonding at this stage may bring benefits that extend well beyond the intervention period.

The sustainability of these benefits may depend on whether mothers incorporate the skills acquired during the intervention into their everyday caregiving routines. Although the structured program lasted four weeks, its broader value may lie in encouraging mothers to maintain regular positive interactions through affectionate touch, eye contact, verbal communication, and attention to infant cues. Such interactions are consistent with responsive caregiving principles within the nurturing care framework, which emphasizes the importance of consistent and sensitive caregiver–infant engagement for early development (Britto et al., 2017; Vaivada et al., 2017). Community-based follow-up through Posyandu services could help reinforce these practices, identify difficulties mothers encounter, and provide additional guidance as needed. However, longer-term studies are required to determine whether the improvements in bonding observed after the intervention are maintained over time.

These findings have clear implications for nursing and midwifery practice. Infant massage is low-cost, requires no special equipment, and fits easily into existing community services. The Posyandu provides a regular point of contact where nurses, midwives, and community health volunteers can teach massage, observe mothers' techniques, and provide feedback. This approach is in line with the nurturing care framework, which calls for support for responsive caregiving to be built into routine health services (Britto et al., 2017; Vaivada et al., 2017). However, success depends on how the program is delivered. The caring behavior of health workers and the quality

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of their relationship with clients influence engagement and trust (Ardiana et al., 2022), and caring behavior is itself shaped by motivation, workload, and rewards in the work environment (Afandi et al., 2025). Health services that wish to scale up infant massage should therefore invest in training and supporting the staff who deliver it, not only in teaching the technique to mothers.

Another important consideration is the role of family and community support in sustaining mother-delivered infant massage beyond the intervention period. Although mothers are the primary providers of daily caregiving, the consistency of these practices may be influenced by family involvement, competing household responsibilities, and access to continued guidance from health professionals. Community-based services such as Posyandu provide opportunities for nurses, midwives, and community health volunteers to reinforce maternal skills, address practical difficulties, and encourage responsive interactions at home. Integrating infant massage education into existing maternal and child health activities may therefore improve continuity of support and strengthen the implementation of nurturing care principles (Britto et al., 2017; Vaivada et al., 2017). However, the contribution of family support and community follow-up to the long-term maintenance of mother–infant bonding requires further investigation.

This study has several limitations. First, participants were selected through purposive sampling and were not randomized, so selection bias cannot be fully ruled out, even though baseline scores were similar. Second, the sample was small and drawn from one city, which limits generalizability. Third, bonding was measured by maternal self-report, and mothers who knew they were in the intervention group may have reported more positive feelings; the observational data were also collected by researchers who were not blinded to group allocation. Fourth, mothers in the intervention group received eight monitoring visits, whereas the control group did not, so part of the effect may reflect extra attention and support rather than massage alone. Finally, the follow-up was brief, and no physiological markers, such as oxytocin or cortisol, were measured.

Future studies should use randomized designs with an attention-matched control group, larger and more diverse samples, blinded observational measures of mother–infant interaction, and longer follow-up to test whether improvements in bonding are maintained and translate into better child development outcomes. Including biological markers and screening for maternal depression would also help clarify for whom, and through which pathways, infant massage is most effective.

CONCLUSION

Mother-delivered infant massage practiced twice weekly for four weeks significantly improved mother–infant bonding among infants aged 6–12 months compared with routine care. Mothers became warmer and more responsive, and infants were calmer and more engaged during interaction. Infant massage is a simple, low-cost, and acceptable intervention that nurses and midwives can integrate into Posyandu and other community-based maternal and child health services to support early relational health.

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