


Impact of infant massage on infant growth, development, and mother–infant interaction

Siti Rohmah¹, Triana Indrayani¹, Retno Widowati¹, Vivi Silawati¹

¹Master of Midwifery, Faculty of Health Science, Universitas Nasional, Indonesia

Corresponding Author: Siti Rohmah, sitirohmah150279@gmail.com



Article Info:

Submitted:
11-09-2025
Revised:
09-03-2026
Accepted:
10-03-2026
Published:
17-03-2026


Keywords:

development,
growth,
infant massage,
mother–infant
interaction

ABSTRACT

The prevalence of growth and developmental disorders among toddlers remains high, reaching 28.7%, and children experiencing early growth delays are at increased risk of developing non-communicable diseases such as diabetes and cardiovascular disorders later in life. Developmental delays that occur before age 20 may persist and affect long-term health outcomes. This study aimed to examine the impact of infant massage on growth, development, and mother–infant interaction among infants aged 6–12 months. A pre-experimental study with a pretest–posttest control group design was conducted. A total of 40 infants aged 6–11 months were recruited using total sampling and allocated into an intervention group (n = 20) and a control group (n = 20). Study instruments included the Bethlehem Mother–Infant Interaction Scale (BMIS), the Ages and Stages Questionnaire–Third Edition (ASQ-3), standardized infant massage procedures, observation sheets, weight scales, and length measurement tools. Data were analyzed using descriptive statistics and nonparametric inferential tests, including the Wilcoxon Signed Ranks Test for within-group comparisons and the Mann–Whitney U Test for between-group comparisons. The results demonstrated significant improvements in growth, developmental outcomes, and mother–infant interaction following infant massage in the intervention group. In contrast, no significant changes were observed in the control group across assessment periods. Significant differences were also identified between the intervention and control groups. In conclusion, infant massage is effective in enhancing growth, development, and mother–infant interaction among infants in Depok City. Training and educational programs on proper infant massage techniques are recommended for mothers to promote regular practice at home, strengthen emotional bonding, and support optimal infant development.

 <https://doi.org/10.53713/nhsj.v6i1.593>

This work is licensed under  CC BY-SA License.

INTRODUCTION

The first five years of life represent a critical developmental window during which the foundational neural architecture is established, with approximately 80% of brain growth occurring between birth and age 6 (Seraji et al., 2025). This period of heightened neuroplasticity renders infants exceptionally responsive to environmental inputs, which shape emerging capacities in cognition, language, emotional regulation, and social behavior (Alpuğan, 2024). Suboptimal development during these early years may have enduring consequences, including increased vulnerability to non-communicable diseases and persistent developmental challenges later in life (Draper et al., 2024). Consequently, evidence-based strategies that support healthy growth trajectories during infancy are of significant public health importance, particularly given the irreplaceable nature of this sensitive period (Vaivada et al., 2022).

Within this developmental context, the quality of early caregiving relationships plays a pivotal role in shaping infant outcomes (Wang et al., 2022). Sensitive, responsive caregiving fosters secure attachment and supports the co-regulation of infant physiology and emotion, laying the groundwork for healthy socioemotional development (Kolacz & Porges, 2024). Physical contact between caregiver and infant serves as a primary channel for this interaction, triggering bidirectional neuroendocrine responses—most notably oxytocin release—that promote bonding, reduce stress reactivity, and enhance mutual attunement (La Rosa et al., 2024). These early interactional patterns not only influence immediate behavioral states but also shape long-term developmental pathways, underscoring the importance of interventions that strengthen the caregiver–infant dyad (Ugarte & Hastings, 2024).

Infant massage has emerged as a promising non-pharmacological intervention that integrates nurturing touch with structured caregiver–infant engagement (Norman & Roggman, 2025). As a form of tactile stimulation, it addresses a fundamental sensory need while providing opportunities for synchronous interaction through eye contact, vocalization, and responsive caregiving (Nousia, 2023). Unlike passive touch, infant massage involves intentional, rhythmic stroking that may enhance maternal sensitivity to infant cues and promote mutual regulation (Monfared et al., 2026). Given its low cost, cultural adaptability, and potential for integration into routine caregiving, infant massage warrants rigorous evaluation as a scalable early intervention strategy to support developmental health (Priyadarshi et al., 2022).

Proposed mechanisms underlying the benefits of infant massage operate across physiological and relational domains. Physiologically, massage may stimulate vagal tone, enhance gastrointestinal function and nutrient absorption, while modulate stress hormones and increasing growth-promoting catecholamines (Budiarti & Suryawan, 2023). Neurochemically, it may elevate serotonin and beta-endorphin levels, supporting immune function and neural maturation (Sutrisni et al., 2023). Relationally, the dyadic nature of massage—combining touch with affective communication—strengthens reciprocity and emotional engagement between mother and infant (McParlin et al., 2023). Together, these pathways may contribute to improvements in anthropometric growth, motor and cognitive development, sleep regulation, and the quality of early attachment behaviors (Rakhmawati et al., 2025).

Despite growing interest in infant massage, significant gaps remain in understanding its differential effects across developmental domains and populations. Concerns regarding technique safety, variability in implementation protocols, and limited high-quality evidence from diverse cultural contexts have hindered widespread clinical adoption (Chen et al., 2024). This review synthesizes current evidence on the impact of infant massage on three interrelated outcomes: infant growth (as measured by weight, length, and head circumference), developmental progression across motor, language, and socioemotional domains, and the quality of mother–infant interaction. By critically evaluating mechanistic pathways and the efficacy of interventions, this analysis aims to inform evidence-based recommendations for integrating infant massage into early childhood health promotion frameworks.

METHOD

Research Design

This study employed an experimental research design using a pretest–posttest control-group design. Both the experimental and control groups were randomly selected from a homogeneous population to ensure comparable baseline characteristics. Prior to the intervention, all participants underwent baseline assessments (pretest). Mothers in the

experimental group received structured training in infant massage techniques, following a standardized operating procedure (SOP). Following training, the researcher evaluated each mother's competency to ensure correct application of the techniques. Subsequently, mothers in the experimental group administered infant massage daily under researcher supervision for 30 consecutive days. The control group did not receive any massage intervention throughout the study period.

Participants

Participants comprised mothers and their infants, randomly selected from a homogeneous population. Random assignment to experimental and control groups was used to minimize selection bias and ensure baseline characteristics were equivalent between groups prior to the intervention. This approach enhanced the study's internal validity by controlling for confounding variables related to participant demographics and initial conditions.

Data Collection

Data were collected at two time points: before the intervention (pretest) and after the 30-day intervention period (posttest). Baseline and follow-up assessments measured three primary outcomes: infant growth, infant development, and mother–infant interaction. The instruments used included: The Bethlehem Mother–Infant Interaction Scale (BMIS) to assess mother–infant interaction quality; The Ages and Stages Questionnaire–Third Edition (ASQ-3) to evaluate infant developmental status; Infant weighing scales for body weight measurement; A measuring tape (metline) for anthropometric assessment; Observation sheets for procedural monitoring; A standardized infant massage SOP to guide and standardize the intervention delivery. All assessments were conducted using identical instruments and procedures at both time points to ensure measurement consistency.

Data Analysis

Data analysis incorporated both descriptive and inferential statistical methods. Descriptive statistics were used to summarize participant demographic characteristics and outcome variables at baseline and follow-up. For inferential analysis, nonparametric tests were used due to the data distribution. The Wilcoxon Signed Ranks Test was used to examine within-group differences between pretest and posttest scores for each group. The Mann–Whitney U Test was employed to compare posttest outcome scores between the experimental and control groups. Statistical significance was determined according to established criteria for nonparametric testing.

Ethical Clearance

The study protocol received ethical approval from the Faculty of Health Science, Universitas Nasional, prior to participant recruitment and data collection. This approval ensured that the research adhered to the ethical standards governing human-subject research, including principles of informed consent, confidentiality, and participant safety.

RESULT

Respondent Characteristics

The analysis of respondent characteristics is presented in Table 1. The frequency distribution of respondents in both the intervention and control groups is shown in the table.

Table 1. Frequency distribution of respondent characteristics

Respondent Characteristics	Intervention Group		Control Group	
	n	%	n	%
Age				
6 months	8	40	3	15
7 months	2	10	1	5
8 months	1	5	1	5
9 months	2	10	1	5
10 months	4	20	4	20
11 months	3	15	10	50
Sex				
Male	7	35	11	55
Female	13	65	9	45
Mode of delivery				
Vaginal delivery	14	70	13	65
Caesarean Section	6	30	7	35

Based on Table 1, the distribution of infants by age in the intervention group was predominantly 6 months (40.0%), whereas in the control group, most infants were 11 months old (50.0%). Female infants predominated in the intervention group (65.0%), whereas male infants were more common in the control group (55.0%). Most infants in both groups were delivered vaginally, accounting for 70.0% in the intervention group and 65.0% in the control group.

Based on Table 1, the data also indicate that most respondents experienced early puberty (63.0%), maternal age at menarche <12 years (72.0%), abnormal nutritional status (58.0%), frequent fast-food consumption (59.0%), low physical activity (64.0%), high stress levels (67.0%), and exposure to pornography (51.0%).

Infant Growth

The analysis of infant growth outcomes is presented in Table 2.

Table 2. Infant growth outcomes

Growth Parameters	N	Pretest			Posttest			Wilcoxon Signed Rank Test
		Mean	Std. Deviation	Min-Max	Mean	Std. Deviation	Min-Max	
Intervention Group								
Body Weight	20	8.290	1.2711	6.4-10.8	8.845	1.2020	7.0-11.0	0.001
Body Length		70.645	4.4931	64.6-78.2	71.350	4.3110	65.8-78.5	0.001
Head Circumference		44.050	1.9694	41.3-48.0	44.145	1.9127	41.4-48.0	0.002
Control Group								
Body Weight	20	9.020	1.1020	7.0-11.0	9.055	1.0674	7.2-11.0	0.038
Body Length		73.080	3.5969	65.0-77.2	73.105	3.5948	65.0-77.2	0.059
Head Circumference		45.330	1.0219	43.0-46.8	45.345	1.0128	43.1-46.8	0.083

Table 2 shows that, prior to infant massage, the mean body weight, body length, and head circumference in the intervention group were 8.290 kg, 70.645 cm, and 44.050 cm, respectively. After the infant massage intervention, the mean body weight increased to 8.845 kg, the mean body length to 71.350 cm, and the mean head circumference to 44.145 cm. In the control group,

the mean body weight before the observation period was 9.020 kg, the mean body length was 73.080 cm, and the mean head circumference was 45.330 cm. After the observation period, the mean body weight was 9.055 kg, the mean body length was 73.105 cm, and the mean head circumference was 45.345 cm. The Wilcoxon Signed Rank Test revealed statistically significant differences in growth parameters before and after the intervention in the intervention group (p value $< \alpha = 0.05$), indicating that infant massage was effective in improving growth outcomes. In contrast, the control group showed no statistically significant differences before and after the observation period (p value $> \alpha = 0.05$), indicating no significant growth changes.

Infant Development

The analysis of infant developmental outcomes is presented in Table 3.

Table 3. Infant development outcomes

Development Domains	N	Pretest			Posttest			Wilcoxon Signed Rank Test
		Mean	Std. Deviation	Min-Max	Mean	Std. Deviation	Min-Max	
Intervention Group								
Communication	20	25.50	10.501	15-45	43.50	6.509	30-55	0.001
Gross Motor		26.25	3.932	20-30	43.75	4.833	30-55	0.001
Fine motor		26.50	9.191	15-45	43.75	2.751	40-50	0.001
Problem solving		26.00	8.974	15-45	43.00	6.366	25-55	0.001
Personal-Social		25.00	7.947	15-45	46.50	2.856	45-55	0.001
Control Group								
Communication	20	26.75	9.358	15-45	29.25	8.315	15-45	0.014
Gross Motor		26.00	5.282	15-35	28.50	3.663	20-35	0.014
Fine motor		25.75	4.064	20-30	27.75	4.435	20-35	0.011
Problem solving		26.00	8.522	15-45	27.50	7.864	15-45	0.014
Personal-Social		27.50	6.387	15-45	30.25	5.495	20-45	0.005

As shown in Table 3, in the intervention group, the mean pretest scores were 25.50 for communication, 26.25 for gross motor skills, 26.50 for fine motor skills, 26.00 for problem solving, and 25.00 for personal–social development. Following the infant massage intervention, the mean scores increased to 43.50 for communication, 43.75 for gross motor skills, 43.75 for fine motor skills, 43.00 for problem solving, and 46.50 for personal–social development. In the control group, the mean pretest scores were 26.75 for communication, 26.00 for gross motor skills, 25.75 for fine motor skills, 26.00 for problem solving, and 27.50 for personal–social development. Posttest scores increased slightly to 29.25, 28.50, 27.75, 27.50, and 30.25, respectively. The Wilcoxon Signed Rank Test demonstrated statistically significant improvements across all developmental domains in the intervention group (p -value $< \alpha = 0.05$), indicating the effectiveness of infant massage on development. In the control group, statistically significant differences were also observed; however, the magnitude of improvement was substantially lower compared to the intervention group.

Mother – Infant Interaction

The analysis of mother–infant interaction outcomes is presented in Table 4.

Table 4. Mother–infant interaction

Mother-Infant Interaction	N	Pretest			Posttest			Paired T Test
		Mean	Std. Deviation	Min-Max	Mean	Std. Deviation	Min-Max	
Intervention Group	20	7.35	2.007	4-11	4.10	1.373	2-7	0.001
Control Group	20	8.05	1.932	5-11	7.55	2.564	2-11	0.041

Table 4 shows that in the intervention group, the mean mother–infant interaction score before the intervention was 7.35, which decreased to 4.10 after the intervention. In the control group, the mean score decreased slightly from 8.05 before the observation period to 7.55 afterward. The Wilcoxon Signed Rank Test indicated statistically significant differences in mother–infant interaction scores before and after the intervention in both the intervention and control groups (ρ value < $\alpha = 0.05$). These findings suggest that infant massage significantly influenced mother–infant interaction in the intervention group.

Differences in Growth, Development, and Mother–Infant Interaction Between Groups

The analysis of differences in growth, development, and mother–infant interaction between the intervention and control groups is presented in Table 5.

Table 5. Differences in growth, development, and mother–infant interaction between the intervention and control groups

Variable	N	Mean	Std. Deviation	p-value
<i>Growth</i>				
Body weight				
Intervention group	40	8.950	1.1271	0.005
Control group				
Body length				
Intervention group	40	72.228	4.0174	0.009
Control group				
Head circumference				
Intervention group	40	44.745	1.6283	0.027
Control group				
<i>Development</i>				
Communication				
Intervention group	40	36.38	10.315	0.001
Control group				
Gross motor skills				
Intervention group	40	36.13	8.806	0.001
Control group				
Fine motor skills				
Intervention group	40	35.75	8.883	0.001
Control group				
Problem solving				
Intervention group	40	35.25	10.558	0.001
Control group				
Personal-social				
Intervention group	40	38.38	9.295	0.001
Control group				
<i>Mother – infant interaction</i>				
Intervention group	40	5.82	2.678	0.001
Control group				

Based on Table 5, the Mann–Whitney U Test results demonstrated statistically significant differences in growth parameters (body weight, body length, and head circumference), developmental domains (communication, gross motor, fine motor, problem solving, and personal–social), and mother–infant interaction between the intervention and control groups (p value $< \alpha = 0.05$). These findings indicate that infant massage significantly improved growth, development, and mother–infant interaction outcomes compared to the control condition in Depok City, West Java.

DISCUSSION

Growth

Based on the study findings, there were significant differences in infant growth between the intervention and control groups in Depok City, West Java. The t-test results showed a p-value of 0.000 (< 0.05), indicating a statistically significant effect of infant massage on weight gain among infants in the working area of Serang City Primary Health Center. Similarly, a randomized controlled trial conducted by Erçelik and Yılmaz (2023) demonstrated that infants in the massage group had significantly higher mean body weight at week 8 ($p = 0.006$) and greater body length at week 20 ($p = 0.05$) than those in the control group. Measurements of body weight, body length, and head circumference were conducted at weeks 4, 8, 12, 16, and 20. In addition, maternal attachment scores were significantly higher in the massage group ($p = 0.030$), indicating that infant massage is an effective intervention to enhance both physical growth and mother–infant attachment. The underlying mechanisms include increased vagal nerve activity, improved nutrient absorption, enhanced serotonin production, and modulation of beta-endorphin, all of which contribute to growth and physiological stability (Yao et al., 2025).

Infant growth indicators such as body weight, body length, and head circumference remain key benchmarks of healthy development. Under normal conditions, infants aged 0–2 months experience weekly weight gains of approximately 100–200 g, body length increases of 2.5–3.5 cm per month, and head circumference growth of around 1.25 cm per month. Regular massage therapy promotes optimal nutritional intake, improves sleep patterns, reduces cortisol levels, and induces relaxation and comfort in infants (Sueca et al., 2025). From the researchers' perspective, the observed improvement in infant growth following massage therapy is associated with enhanced appetite, improved nutrient absorption through vagal stimulation, better sleep quality, stabilized circulation, and reduced irritability, resulting in healthier, calmer infants.

Development

The findings of this study indicate significant differences in infant development between the intervention and control groups in Depok City, West Java. This result aligns with the systematic review by Priyadarshi et al. (2022), which demonstrated that whole-body massage stimulates parasympathetic nervous system activity via pressure receptors in the skin, thereby increasing vagal tone. Enhanced vagal activity reduces cortisol and catecholamine levels, improves gastrointestinal motility, increases insulin and gastrin secretion, and supports better nutrient absorption and growth. Moreover, infant massage was found to improve calming behaviors and parent–infant interactions, contributing to overall neurodevelopment (McCarty et al., 2023).

Infant massage may help address developmental delays, detect physical abnormalities, reduce hyperactivity, improve sleep patterns, and enhance appetite, particularly in infants with developmental disorders (Kulsuma et al., 2025). Developmental domains include gross motor skills, fine motor skills, language, and personal–social abilities. These domains reflect locomotion

and posture, fine muscle coordination, communication capacity, and social independence, respectively (Fadlalmola et al., 2024). Early-life stimulation plays a crucial role in shaping brain development. Routine tactile stimulation, such as massage and movement exercises, enhances neuronal connectivity and strengthens brain function, supporting long-term developmental outcomes (Melo & Hoffman, 2025). Gentle, rhythmic massage movements also promote emotional regulation, security, and social engagement between infants and caregivers (Chmiel & Kurpas, 2026). From the researchers' viewpoint, infant massage represents a form of direct tactile therapy that provides comfort and security. When performed regularly, massage increases catecholamine release, stimulates brain structure and function, and supports optimal developmental trajectories.

Mother – Infant Interaction

The results of this study demonstrate significant differences in mother–infant interaction between the intervention and control groups in Depok City, West Java. This finding is consistent with the study by Windhorst et al. (2023) in the Netherlands, which reported that Individual Shantala Infant Massage effectively improved parent–child interaction in preventive child healthcare settings. Touch was identified as a fundamental mechanism for enhancing mother–infant bonding, emotional connection, and interactive engagement (Grochowska et al., 2024). Infant massage strengthens emotional bonding, enhances parental responsiveness, and increases caregiver confidence. Infant massage positively influences attachment formation. Touch-based interactions serve as a foundational form of communication that fosters reciprocal affection and emotional security (Hwu et al., 2023).

Bonding is a deep emotional connection between parents and children, particularly between mothers and their children. Loving touch and eye contact facilitate emotional communication and foster self-confidence and positive character traits in children (Feng & Zhang, 2024). During massage, infants perceive tactile stimulation as protection, affection, and care. Regular, properly administered massage strengthens emotional closeness and meets infants' basic needs for physical contact (Mrljak et al., 2021). Touch-based interventions promote oxytocin release in both mothers and infants, thereby reducing stress responses, enhancing social behavior, and supporting sensitive caregiving (Figueiredo et al., 2024). From the researchers' perspective, regular infant massage trains mothers to become more attuned to their infants' cues. Increased skin-to-skin contact, eye contact, and communication enhance maternal confidence and emotional closeness, ultimately strengthening mother–infant interaction.

CONCLUSION

This study demonstrates that infant massage is an effective intervention for enhancing growth, development, and mother–infant interaction among infants aged 6–12 months. Infants who received daily massage from trained mothers showed marked improvements in physical growth, significant advances across all developmental domains, and notably stronger mother–infant bonding, compared with the control group, which showed only minimal changes. Statistical analysis confirmed significant positive effects of the massage intervention both within the experimental group and between groups. These findings support infant massage as a simple, non-invasive, and beneficial practice that can be readily integrated into maternal and child health programs to promote optimal infant development and strengthen early caregiver–infant relationships.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to all parties who contributed to this study, both morally and materially, and through their time, effort, and expertise, which enabled the successful completion of this research.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest associated with this study.

REFERENCES

- Alpuğan, Z. (2024). The impact of early childhood adversity on neurodevelopment: A comprehensive review. *The Journal of Neurobehavioral Sciences*, 11(2), 45-59. <https://doi.org/10.32739/uha.jnbs.11.1539116>
- Budiarti, D., & Suryawan, A. (2023). Massage stimulation's effect on melatonin levels in preterm infants via vagal activity. *Bali Medical Journal*, 12(1), 267-273. <https://doi.org/10.15562/bmj.v12i1.3986>
- Chen, S., Lin, S., Wang, M., Cheung, D. S. T., Liang, J., Cheng, Z., Yuen, C. S., & Yeung, W. (2024). Pediatric massage therapy in infants and children under 5 years: An umbrella review of systematic reviews. *Heliyon*, 10(16), e35993. <https://doi.org/10.1016/j.heliyon.2024.e35993>
- Chmiel, J., & Kurpas, D. (2026). Through Massage to the Brain—Neuronal and Neuroplastic Mechanisms of Massage Based on Various Neuroimaging Techniques (EEG, fMRI, and fNIRS). *Journal of Clinical Medicine*, 15(2), 909. <https://doi.org/10.3390/jcm15020909>
- Draper, C. E., Yousafzai, A. K., McCoy, D. C., Cuartas, J., Obradović, J., Bhopal, S., Fisher, J., Jeong, J., Klingberg, S., Milner, K., Pisani, L., Roy, A., Seiden, J., Sudfeld, C. R., Wrottesley, S. V., Fink, G., Nores, M., Tremblay, M. S., & Okely, A. D. (2024). The next 1000 days: Building on early investments for the health and development of young children. *The Lancet*, 404(10467), 2094-2116. [https://doi.org/10.1016/S0140-6736\(24\)01389-8](https://doi.org/10.1016/S0140-6736(24)01389-8)
- Ergelik, Z. E., & Yılmaz, H. B. (2023). Effectiveness of infant massage on babies' growth, mother-baby attachment, and mothers' self-confidence: A randomized controlled trial. *Infant Behavior and Development*, 73, 101897. <https://doi.org/10.1016/j.infbeh.2023.101897>
- Fadlalmola, H. A., Abedelwahed, H. H., Hamid, H. I., Ali, A. B., Alrahim Algadi, H. A., Farg, S. J., Ahmed Ali, N. M., Elbashir, A. A., Mohammed, M. H., Mohmmmed, S. S., Mousa, S. A., Gaafar, D. A., & Eltyeb, A. A. (2024). Effects of Massage on Self-regulatory Difficulties, Tactile and Oral Abnormalities, and Parenting Stress in Children with Autism Spectrum Disorder (ASD): A Systematic Review and Meta-analysis. *International Journal of Therapeutic Massage & Bodywork*, 17(4), 4. <https://doi.org/10.3822/ijtmb.v17i4.1079>
- Feng, X., & Zhang, Y. (2024). Effects of mother–infant skin-to-skin contact on mother–infant relationship and maternal psychology feelings: A qualitative study. *Nursing Open*, 11(6), e2181. <https://doi.org/10.1002/nop2.2181>
- Figueiredo, A. R., Moniz, P., & Laureano, M. (2024). Touch: a review of the infant-caregiver relationship in the neonatal field. *International Journal of Psychiatric Trainees*, 3(1). <https://doi.org/10.55922/001c.124910>
- Grochowska, A., Kmita, G., Szumiał, S., & Rutkowska, M. (2024). Maternal affective touch and adaptive synchrony in mother-preterm infant interactions: Implications for early bonding processes. *Infant Behavior and Development*, 77, 102002. <https://doi.org/10.1016/j.infbeh.2024.102002>
- Hwu, L., Tzeng, Y., Teng, Y., & Liu, S. (2023). Effects of massage intervention on discharged premature infants' weight, parental stress, and parent–child attachment: A randomized controlled trial. *Infant Behavior and Development*, 72, 101867. <https://doi.org/10.1016/j.infbeh.2023.101867>
- Kolacz, J., & Porges, S. W. (2024). Social co-regulation of the autonomic nervous system between infants and their caregivers. In *WAIMH Handbook of Infant and Early Childhood Mental Health*:

- Biopsychosocial Factors*, Volume One (pp. 169-183). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-48627-2_11
- Kulsuma, D. U., Nurjannah, I., Hartinic, S., & Herinid, E. S. (2025). Effect of massage on improving the sleep quality of children with autism spectrum disorders: A scoping review. <https://doi.org/10.48309/jmpcr.2025.480577.1461>
- La Rosa, V. L., Geraci, A., Iacono, A., & Commodari, E. (2024). Affective Touch in Preterm Infant Development: Neurobiological Mechanisms and Implications for Child–Caregiver Attachment and Neonatal Care. *Children*, 11(11), 1407. <https://doi.org/10.3390/children11111407>
- McCarty, D. B., Willett, S., Kimmel, M., & Dusing, S. C. (2023). Benefits of maternally-administered infant massage for mothers of hospitalized preterm infants: a scoping review. *Maternal Health, Neonatology and Perinatology*, 9(1), 6. <https://doi.org/10.1186/s40748-023-00151-7>
- McParlin, Z., Cerritelli, F., Manzotti, A., Friston, K. J., & Esteves, J. E. (2023). Therapeutic touch and therapeutic alliance in pediatric care and neonatology: An active inference framework. *Frontiers in Pediatrics*, 11, 961075. <https://doi.org/10.3389/fped.2023.961075>
- Melo, A. I., & Hoffman, K. L. (2025). Tactile Stimulation Early in Life and During Adulthood: A Natural Strategy to Prevent or Ameliorate Health Disturbances. In *PsychoNeuroImmunology: Volume 1: Integration of Psychology, Neurology, and Immunology* (pp. 187-245). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-73061-0_7
- Monfared, A., Amini, M., Abolghasemi, J., Mazouri, A., & Boroujeni, Z. D. (2026). Effect of Massage With Verbal Contact by Mothers of Premature Infants on Maternal Attachment and Infant's Motor Performance: A Randomized Controlled Trial. *Health Science Reports*, 9(2), e71697. <https://doi.org/10.1002/hsr2.71697>
- Mrljak, R., Arnsteg Danielsson, A., Hedov, G., & Garmy, P. (2021). Effects of Infant Massage: A Systematic Review. *International Journal of Environmental Research and Public Health*, 19(11), 6378. <https://doi.org/10.3390/ijerph19116378>
- Norman, V. J., & Roggman, L. A. (2025). Effects of infant massage on infant attachment security in a randomized controlled trial. *Infant Behavior and Development*, 78, 102004. <https://doi.org/10.1016/j.infbeh.2024.102004>
- Nousia, A. (2023). Healthy touch and infant massage: Two main factors in infants daily care and healthy development. *European Journal of Education Studies*, 10(6). <http://dx.doi.org/10.46827/ejes.v10i6.4854>
- Priyadarshi, M., Kumar, V., Balachander, B., Gupta, S., & Sankar, M. J. (2022). Effect of whole-body massage on growth and neurodevelopment in term healthy newborns: A systematic review. *Journal of Global Health*, 12, 12005. <https://doi.org/10.7189/jogh.12.12005>
- Rakhmawati, W., Mediani, H. S., Dhamayanti, M., Maryati, I., Setiawan, A. S., Hendrawati, S., ... Rochimat, I. (2025). Potential of Massage Therapy for Improved Growth and Development Among Infants Under 9 Months: A Systematic Scoping Review of Intervention Type, Technique, and Outcome. *Journal of Multidisciplinary Healthcare*, 17, 3931–3943. <https://doi.org/10.2147/JMDH.S475731>
- Seraji, M., Shultz, S., Li, Q., Fu, Z., Calhoun, V. D., & Iraj, A. (2025). Spatial development of brain networks during the first six postnatal months. *Communications Biology*, 8(1), 1514. <https://doi.org/10.1038/s42003-025-08913-z>
- Sueca, I. N., Anton, S. S., Dewi, N. M. U. K., Diaris, N. M., Warmayana, I. G. A. K., Sinarsih, N. K., ... & Karang, N. K. H. R. (2025). The Effect of Massage Stimulation on Sleep Quality among Stunted Children. *Berkala Kedokteran*, 21(1), 47-54. <https://dx.doi.org/10.20527/jbk.v21i1.22100>
- Sutrisni, Halimatus Saidah, & Putri Wahyu Wigati. (2023). Differences in Sleep Quantity in Babies Aged 3-6 Months between before and after the Massage Babies at Posyandu Anggrek Pojok Village of Kediri City in 2023. *Journal of Global Research in Public Health*, 8(2), 173–178. <https://doi.org/10.30994/jgrph.v8i2.479>
- Ugarte, E., & Hastings, P. D. (2024). Assessing unpredictability in caregiver–child relationships: Insights from theoretical and empirical perspectives. *Development and Psychopathology*, 36(3), 1070–1089. <https://doi.org/10.1017/S0954579423000305>

- Vaivada, T., Lassi, Z. S., Irfan, O., Salam, R. A., Das, J. K., Oh, C., Carducci, B., Jain, R. P., Als, D., Sharma, N., Keats, E. C., Patton, G. C., Kruk, M. E., Black, R. E., & Bhutta, Z. A. (2022). What can work and how? An overview of evidence-based interventions and delivery strategies to support health and human development from before conception to 20 years. *The Lancet*, 399(10337), 1810-1829. [https://doi.org/10.1016/S0140-6736\(21\)02725-2](https://doi.org/10.1016/S0140-6736(21)02725-2)
- Wang, K., Qi, Y., Wei, Q., Shi, Y., Zhang, Y., & Shi, H. (2022). Responsive Caregiving and Opportunities for Early Learning Associated With Infant Development: Results From a Prospective Birth Cohort in China. *Frontiers in Pediatrics*, 10, 857107. <https://doi.org/10.3389/fped.2022.857107>
- Windhorst, D. A., Klein Velderman, M., van der Pal, S., & de Weerth, C. (2023). The effects and process of the intervention "Individual Shantala Infant Massage" in preventive child healthcare to improve parent-child interaction: study protocol for a quasi-experimental study. *BMC Complementary Medicine and Therapies*, 23(1), 231. <https://doi.org/10.1186/s12906-023-04039-z>
- Yao, C., Zeng, X., Zhang, S., Xiao, B., Sun, P., Kong, L., ... & Fang, M. (2025). Acupoint massage: a comprehensive descriptive review of its forms, applications, and underlying mechanisms. *Chinese Medicine*, 20(1), 54. <https://doi.org/10.1186/s13020-025-01105-1>