



Therapeutic effects of neonatal massage in low-birth-weight neonates: A narrative review of evidence from the past decade

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Abstract

Introduction: Low birth weight (LBW) neonates are at increased risk of growth restriction, feeding difficulties, and neurodevelopmental delay. Developmental supportive care interventions, such as neonatal massage, have been explored as adjunctive strategies to improve short- and long-term outcomes in this vulnerable population.

Methodology: A narrative review was conducted using electronic databases including PubMed, MEDLINE, CINAHL, Scopus, and the Cochrane Library. Studies published between January 2015 and March 2025 were screened. Randomized controlled trials, quasi-experimental studies, and systematic reviews evaluating neonatal massage in LBW or preterm neonates were included. Outcomes of interest were weight gain, growth parameters, neurodevelopment, feeding tolerance, sleep behavior, length of hospital stay, and safety.

Results: Evidence from randomized trials and systematic reviews indicates that neonatal massage is associated with improved daily weight gain and enhanced feeding tolerance in LBW neonates. Moderate-pressure massage appears to be more effective than light-pressure stimulation. Emerging evidence also suggests potential benefits for neurobehavioral organization and sleep regulation. No significant adverse effects were reported across studies when massage was administered by trained caregivers.

Conclusion: Neonatal massage is a safe, low-cost, non-pharmacological intervention that may enhance growth and selected developmental outcomes in low birth weight neonates. While short-term benefits are well supported, further standardized trials with long-term follow-up are required to strengthen clinical recommendations.

Keywords: Low birth weight, neonatal massage, growth, neurodevelopment, feeding tolerance, developmental care

Introduction

Low birth weight (LBW), defined as a birth weight less than 2500 g, remains a significant global health concern and a major contributor to neonatal morbidity and mortality [1]. LBW neonates are at increased risk for growth failure, feeding intolerance, respiratory instability, altered sensory processing, and long-term neurodevelopmental impairments [2]. These challenges are primarily attributed to physiological immaturity of the neurological, gastrointestinal, musculoskeletal, and autonomic systems [3].

While advances in neonatal intensive care have improved survival, there is increasing recognition that survival alone is insufficient without optimizing developmental outcomes [4]. Developmental supportive care emphasizes minimizing stress and promoting appropriate sensory stimulation during critical periods of brain development [5]. From a physiotherapy perspective, early sensory-motor interventions play a crucial role in enhancing neuroplasticity and functional outcomes in high-risk neonates [6].

Neonatal massage is a structured intervention involving systematic tactile stimulation with or without passive limb movements. Theoretical mechanisms underlying its effects include activation of cutaneous mechanoreceptors, increased parasympathetic (vagal) activity, improved gastrointestinal motility, hormonal modulation, and stress reduction [7,8]. Over the past decade, neonatal massage has gained attention as a low-cost, non-invasive intervention that may support growth and development in LBW infants [9].

Despite increasing research, variability in massage techniques, dosage, and outcome measures complicates interpretation of findings. Therefore, this narrative review aims to synthesize evidence from the past ten years to evaluate the therapeutic effects of neonatal massage in LBW

neonates, with particular emphasis on physiotherapy implications.

Methodology

Study Design

A narrative review approach was adopted to allow comprehensive synthesis of heterogeneous study designs and outcomes [10].

Search Strategy

A systematic literature search was conducted using PubMed, MEDLINE, CINAHL, Scopus, Cochrane Library, and Google Scholar for studies published between January 2015 and March 2025. Search terms included neonatal massage, infant massage, low birth weight, preterm neonates, tactile stimulation, and developmental care.

Inclusion Criteria

Studies were included if they:

- Included LBW or preterm neonates
- Evaluated neonatal massage as a primary intervention
- Reported outcomes related to growth, neurodevelopment, feeding, sleep, or hospitalization
- Were randomized controlled trials, quasi-experimental studies, cohort studies, or systematic reviews
- Were published in English within the specified time frame

Exclusion Criteria

Studies were excluded if they

- Included neonates with major congenital anomalies
- Focused exclusively on term normal-birth-weight infants

- Were case reports, editorials, or narrative opinions
- Lacked clear massage protocols or objective outcome measures

Study Selection (PRISMA Summary)

- **Records identified:** 312
- **After duplicates removed:** 245
- **Screened by title/abstract:** 245
- **Excluded:** 178
- **Full-text assessed:** 67
- **Excluded:** 39
- **Studies included in narrative synthesis:** 28

Physiological Basis of Neonatal Massage

Neonatal massage stimulates low-threshold mechanoreceptors in the skin, leading to increased vagal activity and parasympathetic dominance^[11]. Enhanced vagal tone improves gastric motility and nutrient absorption¹². Massage has also been shown to increase secretion of insulin and insulin-like growth factor-1, supporting anabolic processes and tissue growth^[13]. Additionally, reduced cortisol levels and improved autonomic stability contribute to better energy conservation and physiological regulation^[14].

Effects of Neonatal Massage on Growth and Development

Weight Gain and Growth Parameters

The most consistently reported benefit of neonatal massage in LBW infants is improved weight gain^[15, 19]. Moderate-pressure massage has demonstrated superior outcomes compared to light-pressure stimulation^[16]. Meta-analytic evidence suggests clinically meaningful increases in daily weight gain among massaged infants^[20].

Neurodevelopmental Outcomes

Emerging evidence indicates potential benefits of neonatal massage on motor and cognitive development^[21, 23]. Improved motor scores, behavioral organization, and alertness have been reported, particularly when massage is initiated early and combined with parental involvement^[24].

Feeding Tolerance and Sleep Behavior

Studies report earlier attainment of full enteral feeding, reduced gastric residuals, and improved feeding tolerance in massaged LBW infants^[25]. Improved sleep duration, reduced crying, and better sleep-wake organization have also been observed^[26, 27].

Table 1: Summary of Studies on Neonatal Massage in Low Birth Weight Infants (2015–2025)

| Author | Year | Design | Sample | Massage Protocol | Duration | Outcomes |
|---|------|--------------------|-------------|---------------------------|----------|-------------------------|
| Field <i>et al.</i> ^[15] | 2015 | RCT | 120 preterm | Tactile + kinesthetic | 10 days | ↑ weight, ↑ vagal tone |
| Diego <i>et al.</i> ^[16] | 2016 | RCT | 68 VLBW | Moderate-pressure massage | 10 days | ↑ weight, ↑ IGF-1 |
| Kumar <i>et al.</i> ^[18] | 2018 | Quasi-experimental | 60 LBW | Oil massage | 14 days | ↑ weight |
| Tekgündüz <i>et al.</i> ^[28] | 2019 | RCT | 80 preterm | Massage therapy | 2 weeks | ↓ hospital stay |
| Cho <i>et al.</i> ^[21] | 2020 | RCT | 90 preterm | Infant massage | 14 days | ↑ motor outcomes |
| Li <i>et al.</i> ^[25] | 2021 | RCT | 72 LBW | Massage + routine care | 2 weeks | ↑ feeding tolerance |
| Weerakul <i>et al.</i> ^[19] | 2024 | RCT | 95 VLBW | Structured massage | 10 days | ↑ weight, early feeding |

Discussion

The findings of this narrative review suggest that neonatal massage is a beneficial adjunctive intervention for low-birth-weight neonates, particularly in promoting weight gain and physiological stability^[15, 19]. Weight gain remains a critical clinical marker for discharge readiness and long-term survival, and even modest improvements are clinically significant in this population^[20]. The consistent observation of enhanced daily weight gain across randomized trials strengthens the evidence supporting neonatal massage as an effective intervention.

Physiological mechanisms proposed to explain these effects include increased vagal activity, improved gastrointestinal motility, enhanced nutrient absorption, and hormonal modulation involving insulin and insulin-like growth factor-1^[11, 13]. Reduction in stress hormone levels further contributes to improved metabolic efficiency and energy conservation¹⁴. These mechanisms align with core principles of physiotherapy-led developmental care.

Beyond growth outcomes, neonatal massage demonstrates promising effects on neurodevelopmental and behavioral regulation^[21, 22]. Improved motor organization and alertness may reflect enhanced sensory integration and neuroplastic adaptation during early development. Feeding tolerance and sleep regulation, which are closely linked to neurological maturation, also appear to improve following massage therapy^[25, 27].

Despite encouraging findings, heterogeneity in massage protocols, session duration, and outcome measures limits

direct comparison across studies. Additionally, most studies focus on short-term outcomes, with limited long-term follow-up data extending beyond infancy²³. Standardization of intervention protocols and multicenter trials with longitudinal assessments are necessary to establish definitive clinical guidelines.

Conclusion

Neonatal massage is a safe, non-invasive, and cost-effective physiotherapeutic intervention with demonstrated benefits for growth and selected developmental outcomes in low-birth-weight neonates. Evidence from the past decade supports its integration into neonatal developmental care programs, particularly within NICU settings. Future research should focus on standardized protocols and long-term neurodevelopmental follow-up to strengthen clinical recommendations.

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