



International Journal
of Care Scholars
ISSN: 2600-898X

Effect of Massage Therapy on Hyperbilirubinemia among Neonates Suffering From Neonatal Jaundice: A Randomized Controlled Trial

Rimple Pathania¹, Bharat Pareek², Rajesh Shyoran³, Sain Priya¹, Ramya Kundayi Ravi⁴ & Salizar Mohamed Ludin^{5*}

¹BEE ENN College of Nursing, Jammu, India

²Akal College of Nursing, Eternal University, Himachal Pradesh, India

³Government Medical College & Hospital (GMCH) Sector 32, Chandigarh, India

⁴RAK College of Nursing, RAK Medical and Health Sciences University, Ras Al Khaimah, United Arab Emirates

⁵Department of Critical Care Nursing, Kulliyah of Nursing, International Islamic University Malaysia, Pahang, Malaysia

ABSTRACT

Article History:

Submitted: 24 October 2025

Revised: 16 May 2026

Accepted: 3 June 2026

Published: 1 September 2026

DOI: 10.31436/ijcs.v9i3.540

Corresponding author:

Salizar Mohamed Ludin
Department of Critical Care
Nursing,
Kulliyah of Nursing,
International Islamic
University Malaysia,
Pahang, Malaysia
E-mail: msalizar@iium.edu.my

This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0), which permits non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

See:
<https://creativecommons.org/licenses/by-nc/4.0/>



Background: Neonatal jaundice is a common condition that requires medical attention in newborns. Although phototherapy is considered the first option to treat hyperbilirubinemia in neonates, massage therapy is considered a safer, more affordable, culturally acceptable, and effective alternative to phototherapy in many parts of the world. This study aimed to evaluate the effectiveness of massage therapy for hyperbilirubinemia in neonates with neonatal jaundice.

Methods: A hospital-based, parallel-group, randomized controlled trial was conducted to assess the effectiveness of massage therapy on bilirubin levels in neonates. The neonates were randomly assigned using simple random allocation using sealed opaque envelopes to either an experimental group ($n = 35$), which received massage therapy twice daily for three consecutive days, or a control group ($n = 35$), which received standard treatment. However, only 30 participants in each group completed the study; therefore, a total of 60 participants were included in the final analysis. Blinding was not feasible for participants and care providers; however, outcome assessment was performed by a blinded assessor. The effectiveness of the intervention was evaluated with a significance level of $\alpha \leq 0.05$, and the primary outcome was measured by bilirubin levels on the third day post-intervention.

Results: Although there were no significant differences in the mean $\pm$ SD score of serum bilirubin level on day one ($p = 0.503$) and day two ($p = 0.472$), a statistically significant difference ($p = 0.023$) was observed on day three (Experimental group = 8.01 ± 1.93 , control group = 9.15 ± 1.85) of intervention.

Conclusion: Massage therapy has been shown to be an effective intervention for lowering bilirubin levels in neonates. This study recommends massage therapy as an adjunct treatment for neonatal hyperbilirubinemia.

Keywords: Hyperbilirubinemia; Neonatal; Massage; Phototherapy; Infant; Newborn

INTRODUCTION

Neonatal jaundice is the most common condition requiring medical attention in newborns (1). An elevated level of total serum bilirubin in healthy individuals is referred to as hyperbilirubinemia, while a noticeable yellow coloration in the skin and conjunctiva of newborns is known as neonatal jaundice (1,2). The minimum threshold for visually detecting neonatal jaundice in newborns is approximately 46–68 $\mu\text{mol/L}$ (2.7–4.0 mg/dL). It is common practice to monitor newborns using highly sensitive laboratory tests for hyperbilirubinemia (3). Globally, the prevalence of neonatal hyperbilirubinemia varies significantly, ranging from 4.9% to 44.9% (4). Approximately 60% of full-term and 80% of preterm newborns experience neonatal jaundice within the first week of life (1).

Although neonatal jaundice is generally not a cause for grave concern, it is important to closely observe newborns for indications of hyperbilirubinemia and acute bilirubin-related complications (2,5). Newborns with severe hyperbilirubinemia are at risk of developing bilirubin-induced neurological dysfunction (BIND). Bilirubin binds to the globus pallidus, hippocampus, cerebellum, and subthalamic nuclear bodies, causing neurotoxicity. Acute bilirubin encephalopathy (ABE) is characterized by lethargy, hypotonia, and decreased sucking reflexes (6–8). At this stage, the disease was reversible. However, if ABE progresses, patients may develop chronic bilirubin encephalopathy/kernicterus, which is irreversible. It manifests as choreo-athetoid cerebral palsy, seizures, arching, posturing, gaze abnormality, and sensorineural hearing loss (6,8). Neurodevelopmental impairments, hearing impairment, and irreversible cerebral damage are a few other complications of hyperbilirubinemia (5,9).

Phototherapy is the standard treatment for hyperbilirubinemia, particularly in newborns with elevated bilirubin levels. It is crucial to initiate phototherapy based on specific criteria, including the gestational age of the infant and associated risk factors. This approach ensures that the treatment is tailored to the individual needs of the neonate, optimizing the effectiveness of the intervention while minimizing potential complications associated with hyperbilirubinemia. Newborns who breastfeed exclusively, particularly those who consume inadequate calories, are at an increased risk

of hyperbilirubinemia (10); despite its adverse effects, such as retinal and genital damage, dehydration, diarrhoea, and Bronze Children's Syndrome, phototherapy is still a choice for hyperbilirubinemia treatment. Therefore, in the pursuit of options to reduce phototherapy, complementary and alternative medical approaches are increasingly being included in healthcare systems worldwide (11).

Massaging infants immediately after birth is a tradition used to treat a wide range of diseases in certain cultures (12,13). When performed scientifically, massage therapy is found to be beneficial in increasing body mass, enhancing sleep-wake cycles, increasing maternal and newborn well-being, enhancing neurodevelopment in premature infants, decreasing infant stress, lowering cortisol levels in the blood, facilitating early bowel movements, and increasing the frequency of stools in full-term newborns, thereby promoting the elimination of bilirubin and leading to lower bilirubin levels (14–16). Research indicates that infant massage can play a critical role in reducing bilirubin levels by increasing the frequency of defecation, thereby facilitating the elimination of bilirubin from the body, and recommends that massage therapy to be integrated into health services as an adjunct approach for hyperbilirubinemia among neonates (15,17–19). When integrated into newborn care, massage therapy has the potential to significantly decrease treatment costs, minimize associated negative effects, and enhance recovery from hyperbilirubinemia (10,11).

The prevalence rates of neonatal jaundice in India were 33% and 47% in 2019 and 2020, respectively (15). Studies examining the effect of massage therapy on lowering serum bilirubin levels in Indian neonates have yielded conflicting results. Earlier studies have found a beneficial effect of massage therapy in lowering serum bilirubin levels in neonates, whereas a systematic review of clinical trials assessing the effect of body massage on growth and neurodevelopment in healthy term newborns found no clear benefits (16,20,21). Furthermore, a few studies have recommended infant massage as a safe and affordable intervention that can complement phototherapy in the treatment of neonatal jaundice (13). This could be because newborns with hyperbilirubinemia respond differently to various treatment methods based on factors such as race, ethnicity, age, and specific treatment modalities used.

Although massage therapy has been suggested as a supportive intervention for reducing neonatal hyperbilirubinemia, evidence from well-designed randomized controlled trials remains limited, particularly in India. Existing studies show inconsistent findings and vary in methodological rigor, creating a clear gap in high-quality evidence to guide clinical practices (18). Considering the aforementioned evidence, there is a notable scarcity of studies and limited evidence regarding the effectiveness of massage therapy in decreasing serum bilirubin levels among neonates admitted to the selected settings in northwestern India. This gap in the research underscores the need for further exploration of alternative treatment options for neonatal jaundice, a condition that poses significant health risks if left unaddressed. To address this deficiency, the current study assessed the effectiveness of massage therapy on serum bilirubin levels in neonates admitted to the selected setting. By investigating this intervention, this study aimed to contribute valuable insights to the existing body of knowledge and potentially enhance the treatment protocols for managing hyperbilirubinemia in this region.

Hypothesis

There was no significant difference in the bilirubin levels between the neonates who received massage therapy and those who received standard care.

Aim

This study aimed to evaluate the effectiveness of massage therapy for hyperbilirubinemia in neonates with jaundice.

METHODS

Study Design and Setting

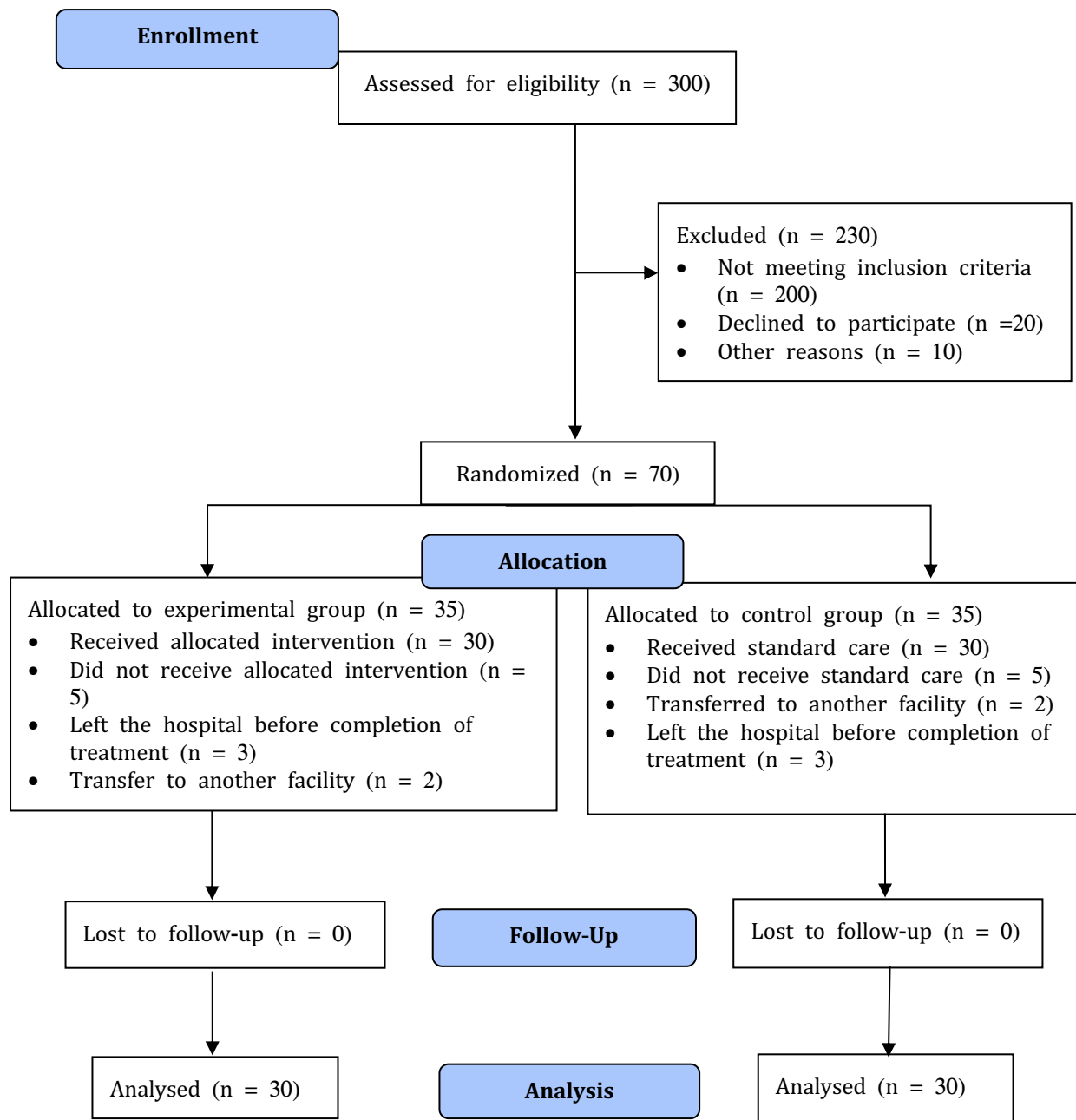
This parallel group (1:1 allocation ratio), randomized controlled trial was conducted from February to April 2023 among neonates admitted to two selected hospitals in the Mohali district of Punjab. Both hospitals were multi-specialty referral hospitals with a capacity of more than 100 beds and dedicated obstetric, gynecological, and neonatal care units.

Population, Sample and Sample Size

The target population included all neonates admitted to the selected hospitals with a diagnosis of neonatal hyperbilirubinemia. All neonates admitted to the selected hospitals were screened for eligibility. Eligible neonates were identified using the maternity unit birth register. All neonates aged 1-28 days, born with a birth weight of 2500–3600 g, receiving treatment for hyperbilirubinemia, and whose bilirubin level was 5 to 15 mg/dl were included in the study. Neonates were excluded if they had Rh or ABO incompatibility, any medical or surgical condition other than physiological jaundice (including hemolytic disorders, congenital infections, metabolic disorders, or hepatic disorders affecting bilirubin metabolism), were exclusively formula fed, or had a history of exchange transfusion in siblings.

The sample size was calculated based on a 95% confidence level ($Z = 1.96$), $\alpha = 0.05$, desired power of 80% (0.8), and a standard deviation of 6.52, estimated from a pilot study. The calculated effect size was 0.75. Accordingly, a minimum of 54 participants (27 per group) is required. To account for possible attrition, the final sample size was increased to 70 participants (35 in each group). However, owing to attrition and incomplete data, the final analysis included 60 participants (30 per group).

Of the eligible 70 neonates, participants were randomly allocated to either the experimental or control group using a simple randomization (lottery) method. The allocation sequence was generated using a random process, and group assignments (35 per group) were placed in sequentially numbered, opaque, sealed, and tamper-proof envelopes. The envelopes were securely prepared and shuffled to ensure allocation concealment. A co-investigator not involved in enrolment or intervention delivery managed the allocation process. Each participant selected an envelope to determine their group assignment. Recruitment continued until the required sample size was reached. A total of 300 neonates were screened for eligibility, and the primary outcome data for the current study were obtained from 60 neonates, forming the analytical sample (**Figure 1**).

Figure 1: Consort Flow Diagram

Measurement, Reliability, Validity and Data Collection

A structured data sheet was used to capture the characteristics of the neonates who participated in this study. Section one collected sociodemographic information using structured closed-ended questions, such as age, gender, and mode of delivery. Section two collected the outcomes of the study (serum bilirubin level) from days one to three. Information regarding sections one and two was collected for neonates enrolled in both the experimental and control groups.

The study protocol and instruments were developed based on an existing literature review under the guidance of experts, based on the purpose of the study.

The data collection instrument used in this study was developed in consultation with a team of experts, based on the existing literature. A panel of five experts from medicine, pediatric nursing, and biostatistics evaluated the items of the instruments in terms of clarity, appropriateness, and accuracy. The content validity of the instrument was 0.99. Serum bilirubin levels

were assessed using standardized laboratory procedures in the hospital biochemistry laboratory, following quality control protocols to ensure the accuracy and consistency of measurements. The instrument was pilot-tested on five neonates, but no modifications were made.

Before the main study, a pilot study was conducted to determine the study's viability and practicality, identify any potential obstacles that might arise during the study, and finalize the sample size and methods for data analysis. The results of the pilot study revealed a positive effect of massage therapy in decreasing hyperbilirubinemia in neonates. No changes were made to the study protocol after the pilot study.

Blinding was applied at the outcome assessment. Transcutaneous bilirubin measurements were performed by a co-investigator who was unaware of the group allocation. Due to the nature of the intervention, blinding of the participants and care providers was not feasible. To minimize potential bias, standardized procedures were used for data collection, validated tools were applied, and data analysis was conducted using appropriate statistical methods.

Intervention

The neonates enrolled in the study were randomized into two groups: control and experimental. Neonates in the experimental group received massage therapy twice a day (morning = 15 minutes, evening = 15 minutes) for three days approximately 30 minutes after the first morning and midday feeds, from the first day to the third day of enrollment in the study. Massage therapy was administered by the primary investigator, who was trained in massage therapy, and phototherapy was stopped while performing the infant massage. Standardized procedures were strictly followed for all sessions, including uniform application of pressure, consistent stroke patterns, and a predefined sequence of massage movements to ensure intervention fidelity. The investigator's hands were warmed to infant body temperature before massage oil (virgin coconut oil) massage, and the room temperature was maintained between 26 °C and 28 °C. Massage was performed according to the International Association of Infant Massage (IAIM)

guidelines (22). Neonates enrolled in the experimental group received all routine and standard care provided in the hospital. Serum bilirubin levels were measured in all neonates on days one, two, and three of the study period. The Consolidated Standards of Reporting Trials (CONSORT) statement was used to perform the study.

Statistical analysis

The final analysis was performed on 60 samples, as 10 neonates (five each in the experimental and control groups) were lost during follow-up. Data were analyzed using SPSS-26. The data were checked for outliers, wild codes, irregularities and missing values. The normality of the data was assessed by plotting the frequency distributions of the selected variables. The mean, median, and mode were comparable, suggesting that the data followed a normal distribution. The equality of variances was determined using Levene's test. Descriptive statistics, such as frequency, percentage, mean, and standard deviation, were used to summarize the variables. The chi-square and Fisher's exact tests were used to test the differences in categorical data, and an independent t-test was used to evaluate the differences between the mean values of the experimental and control groups. In all tests, a 95% confidence interval and significance level of $\alpha = 0.05$ were considered.

Ethical Considerations

This study was approved by the Institutional Ethics Committee (IEC/SPHE/0010/2022) of the SPHE College of Nursing. The Indian Registry (CTRI) approved the study protocol of clinical trials with the code and was prospectively registered under CTRI (CTRI/2023/05/053273). Official permission was obtained from hospital administrators. The purpose, nature, and expected outcomes of the study were explained to both parents before enrolment and before obtaining informed written consent. They were given enough time to clarify their doubts and were allowed to withdraw at any time of the study. Participation in this study was voluntary. Privacy and confidentiality were ensured throughout this study. No adverse events related to the intervention were observed during the study period.

RESULT

Neonates enrolled in both the experimental and control groups were found to be

homogeneous in terms of demographic, physical, and physiological characteristics, except for weight (**Table 1**).

Table 1: Comparison of Baseline Characteristics of Neonates Between Experimental and Control Group (N = 60)

Variable		Experimental Group N=30	Control Group N=30	Chi-square/t-value	p-value
Gender (f, %)	Male	19 (52.8)	17 (47.2)	0.598	0.396
	Female	11 (45.8)	13 (54.2)		
Mode of delivery (f, %)	NVD	16 (50)	16 (50)	1	0.602
	LSCS	14 (50)	14(50)		
Mode of feeding (f, %)	Breast Feeding	13 (48.1)	14 (51.9)	0.572	0.796
	Formula feeding	11 (57.9)	8 (42.1)		
	Mixed	06 (42.9)	8 (57.1)		
Serum Bilirubin level, Mean $\pm$ SD		11.0 $\pm$ 2.3	10.5 $\pm$ 2.05	1.060	0.308
Hospitalization, Mean $\pm$ SD		2.33 $\pm$ 1.06	1.90 $\pm$ 0.89	2.951	0.091
Age, Mean $\pm$ SD		8.30 $\pm$ 3.08	9.7 $\pm$ 3.19	2.978	0.090
Gestational Age, Mean $\pm$ SD		36.23 $\pm$ 1.30	35.93 $\pm$ 1.28	0.805	0.373
Length, Mean $\pm$ SD		49.60 $\pm$ 1.94	49.43 $\pm$ 1.94	0.111	0.741
Weight, Mean $\pm$ SD		2.80 $\pm$ 0.51	3.1 $\pm$ 0.38	8.762	0.004*

*p-value < 0.01

Serum bilirubin levels were comparable between the two groups on days one and two. However, a significantly lower serum bilirubin level was observed in the

experimental group (8.01 $\pm$ 1.93) than in the control group (9.15 $\pm$ 1.85) on day three (**Table 2**).

Table 2: Effectiveness of Massage Therapy Among Neonates with Hyperbilirubinemia (N = 60)

Day	Group	Bilirubin level Mean $\pm$ SD	Levene's statistic	Sig. value/F value	95% Confidence Interval for Mean		p-value
					Lower Bound	Upper Bound	
Day 1	Experimental	10.58 $\pm$ 2.15	0.933	0.338/0.455	9.776	11.383	0.503
	Control	10.23 $\pm$ 1.81			9.555	10.911	
Day 2	Experimental	9.28 $\pm$ 2.07	0.197	0.659/0.524	8.503	10.056	0.472
	Control	9.65 $\pm$ 1.87			8.949	10.350	
Day 3	Experimental	8.01 $\pm$ 1.93	0.429	00.515/5.444	7.289	8.737	0.023
	Control	9.15 $\pm$ 1.85			8.463	9.849	

DISCUSSION

The findings from this RCT indicate that among neonates receiving treatment for hyperbilirubinemia, bilirubin levels were similar between the experimental (massage therapy) and control groups during the first two days. However, a significant reduction in bilirubin levels was observed in the massage therapy group on the third day of the intervention. This suggests that massage therapy may not yield immediate results but becomes effective after consistent application

over two consecutive days. These results reveal the efficacy of massage therapy in reducing hyperbilirubinemia, positioning it as a viable alternative or complementary treatment to traditional methods such as phototherapy.

The results of our study align with those of previous research that endorses the effectiveness of massage therapy in alleviating hyperbilirubinemia. A meta-analysis encompassing 20 studies identified a notable dose-response relationship between massage

therapy and the decrease in bilirubin levels in neonates with jaundice. The study also found that massage promotes the expulsion of the meconium and decreases the reabsorption of bilirubin into the bloodstream (18); another meta-analysis study conducted by Min Zhang et al. also indicated that massage therapy can effectively reduce bilirubin levels in cases of neonatal hyperbilirubinemia (23). A clinical trial review conducted by Garg et al. indicated that massage therapy was effective in reducing bilirubin levels in both term and preterm neonates, suggesting its potential as a complementary treatment for neonatal hyperbilirubinemia (24). A randomized controlled trial by Kumar et al. demonstrated that oil massage administered alongside phototherapy significantly increased stool and urine output and reduced the duration of phototherapy among term neonates with unconjugated hyperbilirubinemia, supporting massage as a potentially beneficial adjunctive intervention for neonatal jaundice management (25). Additionally, an RCT conducted in Taiwan among full-term healthy neonates revealed that infant massage has the potential to lower bilirubin levels and enhance defecation frequency in neonates receiving phototherapy for jaundice (13). A double-blind clinical trial in Iran with 90 term neonates suffering from hyperbilirubinemia also found that adding either massage or Kangaroo Mother Care (KMC) to phototherapy significantly lowered bilirubin levels, reduced the duration of phototherapy, and decreased hospital stay compared with phototherapy alone (26). These studies align with the results of the current study, highlighting the effectiveness of massage for managing hyperbilirubinemia in neonates.

Our study suggests that a sustained approach is necessary to achieve significant improvements in bilirubin levels. The benefits of massage therapy for reducing bilirubin levels in full-term neonates are evident only after consistent application over two days rather than yielding prompt results. Another study supports the current findings, demonstrating that serum bilirubin levels decreased notably following massage therapy (27). Massage provides both physiological benefits and enhances the emotional bond between parents and infants, particularly during times of limited physical contact, such as in hospitals. This dual advantage emphasizes the importance of incorporating massage as a supportive intervention in neonatal care (13,28). Overall, these findings

underscore the potential of massage therapy as an effective adjunctive treatment for managing neonatal hyperbilirubinemia, enhancing both clinical outcomes and the overall well-being of affected infants.

The strengths of this study include its randomized controlled trial design, which reduces selection bias and facilitates reliable group comparisons. The use of a sealed envelope system for random allocation enhances the methodological rigor. Massage therapy was consistently administered by a trained primary investigator to ensure uniformity in the application of the technique. Adherence to CONSORT guidelines improves the transparency and quality of reporting, whereas ethical considerations, such as informed consent and Institutional Ethics Committee approval, highlight the study's commitment to ethical research practices.

This study had several limitations that may affect the generalizability of the findings. The small sample size of 60 neonates may not adequately represent the broader population with hyperbilirubinemia, thus impacting the reliability of the results. Conducting research at a single institution could introduce site-specific biases, limiting the applicability of these findings to other healthcare settings. Another limitation is the short duration of the intervention, which may not capture the long-term effects of massage therapy on bilirubin levels and the overall neonatal health. Significant difference in baseline weight and possible variations in feeding pattern and postnatal age may have acted as potential confounding factors influencing bilirubin levels. Additionally, effect sizes and confidence intervals were not calculated, limiting the interpretation of the magnitude and precision of the findings. Therefore, the results should be interpreted with caution. Reliance on subjective measures to assess outcomes may introduce variability into the results. Additionally, the exclusive use of sweet almond oil for massage, without investigating the effects of other oils or techniques, may limit the generalizability of the findings to various massage practices. This study did not use an intention-to-treat (ITT) analysis; instead, a per-protocol analysis was performed. Therefore, the findings may be subject to potential attrition bias due to the exclusion of participants who did not complete the study.

Based on the findings and limitations of this study, several recommendations for future research can be made. Larger multicenter trials are needed to validate the effectiveness of massage therapy in reducing hyperbilirubinemia in various populations and settings. Future studies should include a longer follow-up period to evaluate the long-term effects of massage therapy on bilirubin levels and overall neonatal health. Additionally, investigating the mechanisms by which massage therapy affects bilirubin levels may provide valuable insights into its efficacy. Lastly, including a broader range of demographic variables would help better understand the factors influencing the outcomes of massage therapy in neonates with hyperbilirubinemia.

In summary, this randomized controlled trial demonstrated the effectiveness of massage therapy as a complementary approach to reduce hyperbilirubinemia in neonates receiving phototherapy. The results suggest that while immediate benefits may not be evident, regular massage therapy over several days can significantly lower bilirubin levels. This finding supports the use of massage therapy as a promising alternative or supplement to conventional treatments, such as phototherapy. Nonetheless, the study is limited by factors such as small sample size, absence of participant blinding, and potential confounding variables, indicating the need for further research to confirm these findings. Future investigations should focus on larger multicenter trials with longer follow-up periods and a wider array of demographic factors to better understand the effects of massage therapy on neonatal health. Overall, this research adds to the increasing evidence supporting non-invasive interventions, such as massage therapy in neonatal care, emphasizing the importance of further investigation into holistic methods for managing conditions such as hyperbilirubinemia.

CONCLUSION

Massage therapy was associated with a statistically significant reduction in serum bilirubin levels on day three among full-term neonates with hyperbilirubinemia receiving phototherapy, while no significant differences were observed on days one and two. These findings suggest that massage therapy may play a supportive role in enhancing bilirubin reduction when used alongside standard

phototherapy. However, given the limited sample size, short duration of follow-up, and single-center design, the results should be interpreted cautiously. Further large-scale, multicenter randomized controlled trials are recommended to confirm these findings before routine clinical implementation.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

No funding received for this study.

ACKNOWLEDGEMENTS

The authors sincerely thank all participating nursing students and the administrators of the participating institutions for their valuable cooperation and support in conducting this study.

AUTHOR CONTRIBUTIONS

RP: Conceptualization, methodology, investigation, data curation, formal analysis and writing of original draft.

BP: Conceptualization, methodology, supervision and critical revision of the manuscript.

RS: Data collection, investigation and critical revision of the manuscript.

SP: Data collection, data curation and critical revision of the manuscript.

RKR: Conceptualization, methodology, statistical analysis, interpretation of findings, and, review and editing the writing.

SML: Supervision, conceptualization, interpretation of findings and critical revision of the manuscript.

REFERENCES

1. Okulu E. Neonatal jaundice: Recommendations for follow-up and treatment. *Global Pediatrics*. 2024 Mar;7:100131. doi:10.1016/j.gpeds.2023.100131.
2. Hulzebos C V., Vitek L, Coda Zabetta CD, Dvořák A, Schenk P, van der Hagen EAE, et al. Screening methods for neonatal hyperbilirubinemia: benefits, limitations, requirements, and novel developments. *Pediatr Res*. 2021 Aug 3;90(2):272–6. doi:10.1038/s41390-021-01543-1
3. Hansen TWR. The epidemiology of neonatal jaundice. *Pediatric Medicine*.

- AME Publishing Company; 2021. doi:10.21037/pm-21-4
4. Aynalem YA, Mulu GB, Akalu TY, Shiferaw WS. Prevalence of neonatal hyperbilirubinaemia and its association with glucose-6-phosphate dehydrogenase deficiency and blood-type incompatibility in sub-Saharan Africa: A systematic review and meta-analysis. *BMJ Paediatrics Open*. BMJ Publishing Group; 2020. doi:10.1136/bmjpo-2020-000750
5. van der Geest BAM, de Graaf JP, Bertens LCM, Poley MJ, Ista E, Kornelisse RF, et al. Screening and treatment to reduce severe hyperbilirubinaemia in infants in primary care (STARSHIP): a factorial stepped-wedge cluster randomised controlled trial protocol. *BMJ Open*. 2019 Jun;9(4):e028270. doi:10.1136/bmjopen-2018-028270
6. Ahmad M, Rehman A, Adnan M, Surani MK. Acute bilirubin encephalopathy and its associated risk factors in a tertiary care hospital, Pakistan. *Pak J Med Sci*. 2020 Sep 1;36(6):1–4. doi:10.12669/pjms.36.6.2222
7. Larasati D, Putri NR. Pijat Bayi Dan Penurunan Kadar Bilirubin Bayi Ikterik: A Scoping Review [Internet]. Vol. 5. 2023. Available from: http://ejournal.poltekkes_smg.ac.id/ojs/index.php/JOMISBAR
8. Zhang F, Chen L, Shang S, Jiang K. A clinical prediction rule for acute bilirubin encephalopathy in neonates with extreme hyperbilirubinemia: A retrospective cohort study. *Medicine (United States)*. 2020;99(9). doi:10.1097/MD.00000000000019364 PubMed PMID: 32118780.
9. Boskabadi H, Zakerihamidi M, Moradi A, Bakhshae M. Risk Factors for Sensorineural Hearing Loss in Neonatal Hyperbilirubinemia. *Iranian Journal of Otorhinolaryngology*. 2018.
10. Jazayeri Z, Sajadi M, Dalvand H, Zolfaghari M. Comparison of the effect of foot reflexology and body massage on physiological indicators and bilirubin levels in neonates under phototherapy. *Complement Ther Med*. 2021 Jun 1;59. doi:10.1016/j.ctim.2021.102684 PubMed PMID: 33609634.
11. Saboth K. Analysis of Prevalence of Neonatal Jaundice Among Young Children in a Tertiary Hospital in India. *Original Research Article*. 2019;297(2):297–9. doi:10.21276/ijmrp.2019.5.2.068
12. Shoghi M, Sohrabi S, Rasouli M. The Effects of Massage by Mothers on Mother-Infant Attachment. *Altern Ther Health Med*.
13. Mrljak R, Arnsteg Danielsson A, Hedov G, Garmy P. Effects of Infant Massage: A Systematic Review. *Int J Environ Res Public Health*. 2022 May 24;19(11):6378. doi:10.3390/ijerph19116378
14. Korkmaz G, Esenay FI. Effects of Massage Therapy on Indirect Hyperbilirubinemia in Newborns Who Receive Phototherapy. *JOGNN - Journal of Obstetric, Gynecologic, and Neonatal Nursing*. 2020 Jan 1;49(1):91–100. doi:10.1016/j.jogn.2019.11.004 PubMed PMID: 31812490.
15. Abdellatif M, Vuong NL, Tawfik GM, Nhu Nguyen DP, Van Thanh L, Elfaituri MK, et al. Massage therapy for the treatment of neonatal jaundice: A systematic review and network meta-analysis. *Journal of Neonatal Nursing*. Elsevier Ltd, 2020. p. 17–24. doi:10.1016/j.jnn.2019.09.002
16. Priyadarshi M, Kumar V, Balachander B, Gupta S, Sankar MJ. Effect of whole-body massage on growth and neurodevelopment in term healthy newborns: A systematic review. *J Glob Health*. 2022;12. doi:10.7189/jogh.12.12005 PubMed PMID: 36254378.
17. Natasha D, Rahmania S, Yulianti DA, Laily D, Humairah F. Journal of Midwifery and Nursing Effectiveness of massage therapy to reduce bilirubin levels in neonates with hyperbilirubinemia a systematic review and metaanalysis. *Journal of Midwifery and Nursing*. 2024.
18. Shahbazi M, Khazaei S, Moslehi S, Shahbazi F. Effect of Massage Therapy for the Treatment of Neonatal Jaundice: A Systematic Review and Dose-Response Meta-analysis. *International Journal of Pediatrics (United Kingdom)*. Hindawi Limited; 2022. doi:10.1155/2022/9161074
19. Sari HE, Yulianti NT. Effectiveness of Massage Therapy For The Treatment Of Neonatal Jaundice: A Systematic Review and Meta-Analysis [Internet]. doi:10.26911/FP.ICPH.09.2022.29
20. Narale DrP, Shinde DrA, Mhaske ProfDSN, Waydande DrS. The beneficial effects of infant massage on jaundiced neonates receiving phototherapy. *VIMS Health Science Journal*. 2023 Mar 31;10(1):01–6. doi:10.46858/vimshsj.10101
21. Kothiyal S, Chatterjee S. Effectiveness of Tactile and Kinaesthetic Stimulation on Hyperbilirubinemia: A Feasibility Study. *Journal Of Clinical and Diagnostic Research*. 2024. doi:10.7860/jcdr/2024/68458.19052

22. Weatherford C. The International Association of Infant Massage Programme and Parent-Infant Relationship Outcomes: A Systematic Review [Master's thesis]. Christchurch (NZ): University of Canterbury, College of Education, Health and Human Development; 2022.
23. Zhang M, Wang L, Wang Y, Tang J. The influence of massage on neonatal hyperbilirubinemia: a meta-analysis of randomized controlled trials. *Journal of Maternal-Fetal and Neonatal Medicine*. Taylor and Francis Ltd; 2019. p. 3109–14. doi:10.1080/14767058.2018.1455183 PubMed PMID: 29631455.
24. Garg BD, Kabra NS, Balasubramanian H. Role of massage therapy on reduction of neonatal hyperbilirubinemia in term and preterm neonates: a review of clinical trials. *Journal of Maternal-Fetal and Neonatal Medicine*. Taylor and Francis Ltd; 2019. p. 301–9. doi:10.1080/14767058.2017.1376316 PubMed PMID: 28870134.
25. Kumar D, Kumar D, Arya PK, Alim M, Sharma IK, Yadav RK, et al. Comparing the effect of oil massage on phototherapy efficacy in term neonates with hyperbilirubinemia: a randomized controlled trial. *Pediatr Gastroenterol Hepatol Nutr*. 2025;28(2):93–100. doi:10.5223/pghn.2025.28.2.93.
26. Kenari R lori, Aziznejadroshan P, Mojaveri MH, Hajian-Tilaki K. Comparing the effect of kangaroo mother care and field massage on serum bilirubin level of term neonates with hyperbilirubinemia under phototherapy in the neonatal ward. *Caspian J Intern Med*. 2020;11(1):34–40. doi:10.22088/cjim.11.1.34
27. Arabzade MJ, Shahshenas S, Alizadeh Taheri P, Borna H, Rafati S, Soltanipur M. Massage therapy as an adjunct to phototherapy in neonatal jaundice: results from a randomized clinical trial. *Egyptian Pediatric Association Gazette*. 2025 Nov 12;73(1):128. doi:10.1186/s43054-025-00477-1
28. Zhang Y, Duan C, Cheng L, Li H. Effects of massage therapy on preterm infants and their mothers: a systematic review and meta-analysis of randomized controlled trials. *Front Pediatr*. 2023 Aug 31;11. doi:10.3389/fped.2023.1198730