

Research Article

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Foot Reflexology Massage Effect on Preterm Neonates' Physiological Response: A Quasi-Experimental Study

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E: mail: adraa.hussein@conursing.uobaghdad.edu.iq. DOI: <https://doi.org/10.58897/qxxx4j24>

ARTICLE INFO

Article History:

Received: 09/12/2025

Accepted: 31/05/2026

Published: 30/06/2026

Keywords:

Foot reflexology,

Preterm infant,

Physiological response,

Neonatal care,

Oxygen saturation,

Non-pharmacological

intervention,

Nursing.

ABSTRACT

Objective(s): To determine the effects of foot reflexology on stabilizing physiological parameters: heart rate, respiratory rate and saturation of oxygen in preterm infants hospitalized in the Neonatal Intensive Care Unit.

Methods: A quasi-experimental study was performed in the Neonatal Intensive Care Unit of Bint Al-Huda Teaching Hospital in Al-Nasiriyah, city, from May 3rd to November 15th, 2025. A purposive sample of 90 preterm infants (30-37 weeks) were allocated into intervention group (n=45) receiving foot reflexology for 20 minutes twice daily for three days, and the control group (n=45) receiving routine care. Physiological parameters were measured before and after message intervention. Data were analyzed using SPSS version 26 with descriptive statistics and Mann-Whitney u test.

Results: No significant baseline differences between groups at pretest. Post intervention, significant enhancement was observed in SpO₂ (p=0.001) and respiratory rate (p=0.001) in the intervention group compared with controls. Heart rate decreased but was not statistically significance (p=0.286). Progressive improvement was noted over the three-day intervention.

Conclusion: Foot reflexology significantly improved oxygen saturation and respiratory rate, supporting its potential as a safe, non-invasive complementary intervention for preterm infants' neonatal intensive care settings.

Recommendations: Using foot-reflexology as a complementary approach, especially for preterm experiencing respiratory oxygen desaturation

تأثير التدليك الانعكاسي للقدم على الاستجابة الفسيولوجية لحديثي الولادة الخدج: دراسة شبه تجريبية

المستخلص

الأهداف: تحديد تأثير تدليك القدم الانعكاسي على استقرار المؤشرات الفسيولوجية: معدل ضربات القلب ومعدل التنفس وتشبع الأكسجين للرضع الخدج الراقدين في وحدة العناية المركزة لحديثي الولادة في المستشفى.

منهجية البحث: تم إجراء دراسة شبه تجريبية في وحدة العناية المركزة لحديثي الولادة في مستشفى بنت الهدى التعليمي في مدينة الناصرية، من ٣ أيار إلى ١٥ تشرين الثاني ٢٠٢٥. تم اختيار عينة غرضية من ٩٠ رضيع خديج (37-30) اسبوع وتوزيعهم عشوائياً الى مجموعتين: مجموعة التداخل (٤٥) التي تلقت تدليك القدم الانعكاسي لمدة ٢٠ دقيقة مرتين يومياً لمدة ثلاثة أيام، والمجموعة الضابطة (45) خديج والتي تلقت العناية الروتينية. تم قياس المؤشرات الفسيولوجية قبل وبعد التدخل بالتدليك. حللت البيانات باستخدام SPSS الإصدار ٢٦ مع استخدام الإحصاء الوصفي واختبار مان ويتني.

النتائج: لم تُلاحظ فروق ذات دلالة إحصائية بين المجموعتين في القياس القبلي. أما بعد التداخل، لوحظ تحسن ملحوظ في تشبع الأكسجين ($p=0.001$) (SpO_2) ومعدل التنفس ($p=0.001$) في مجموعة الدراسة مقارنةً بمجموعة الضبط. أنخفض معدل ضربات القلب، لكن لم يكن ذا دلالة إحصائية ($p=0.286$). كما لوحظ تحسن تدريجي خلال فترة التدخل التي استمرت ثلاثة أيام.

الاستنتاج: تدليك القدم الانعكاسي حسن بشكل ملحوظ تشبع الأوكسجين ومعدل التنفس، مما يدعم إمكانية استخدامه كتدخل تكميلي آمن وغير جراحي للأطفال الخدج في وحدات العناية المركزة لحديثي الولادة.

التوصيات: استخدام العلاج الانعكاسي بالقدم كنهج تكميلي، خاصةً الخدج الذين يعانون من نقص الأوكسجين التنفسي.

الكلمات المفتاحية: تدليك القدم الانعكاسي، الرضيع الخديج، الاستجابة الفسيولوجية رعاية حديثي الولادة، تشبع الأوكسجين؛ التدخل غير الدوائي.

Introduction

World Health Organization WHO reported, there are around 15 million premature alive birth each year. Preterm birth, neonates delivered 37 weeks, are highly vulnerable to extrauterine environmental stressors due to their vital organ immaturity^(1,2). Prematurity is the main cause of mortality among newborns, as reported by the Centers for Disease Control and Prevention^(3,4).

The abrupt transition from intrauterine to extrauterine life presents substantial physiological challenges for preterm neonates, whose organ systems have not achieved the maturity necessary for independent function⁽⁵⁾. Therefore, preterm infants are at an increased risk of experiencing serious health issues⁽⁶⁾. These issues are affecting several body systems including respiratory, cardiovascular, and thermoregulatory functions⁽⁷⁾.

The immaturity of cardiorespiratory system effect on neonates' temperature instability, cardiac and respiratory regulation which are manifested through episodes of apnea, bradycardia and oxygen desaturation.^(8,9,10) Such instability demands close monitoring and help for breathing, circulation, temperature control and feeding in the majority of premature infants during their stay in the neonatal intensive care unit NICU^(11,12).

The modern neonatology certainly has become more concern on the complementary nonpharmacological treatments along with the traditional therapy^(13,14). Foot reflexology, an ancient therapy and one of nonpharmacologic approaches that can enhance the efficacy of treatment of healing. It postulates certain areas on the feet correspond to various organs and systems of the body^(15,16).

Foot reflexology massage method, based on the application of mild pressure to specific reflex points, is believed to elicit a relaxation

response; enhanced circulation and normalized autonomic processes are noticed^(17,18). Research studies have shown that routine tactile stimulation promotes physiological maturation, increases stability of respiration and the heart, and promotes favorable nurse-infant interaction⁽¹⁹⁾. Study conducted in Hamadan at Fatemeh Hospital indicated that foot and palm reflexology have an obvious improvement in oxygen saturation, respiratory rate, and respiratory distress⁽²⁰⁾. The intervention has several advantages: it is safe, non-invasive, cost-effective, easy to learn and fits in with conventional medical care⁽²¹⁾. In addition, another study conducted at NICU in Alexandria reported that, foot reflexology therapy is effective in enhancing the full-term neonates' physiological parameters with jaundice undergoing phototherapy⁽²²⁾.

Nurses are one of the members in a multidisciplinary team in helping and supporting neonates in NICU. They are needed to be instrumented with complementary therapies such foot reflexology massage^(23,24,25). However, these data are available, few studies have investigated the direct influence of foot reflexology on the stability of preterm neonates' physiological parameters, with limited numbers published in Middle-Eastern populations. Despite these promising findings, significant gaps remain in the current evidence base⁽²⁶⁾.

There is considerable variation in reflexology massage protocols in the previous studies, with differences in pressure techniques, session durations, and treatment frequencies making it difficult to establish standardized recommendations. Consequently, the creation of a strong evidence base for the efficiency of foot reflexology in the stabilization of physiological parameters among preterm infants is crucial for practical applications and promoting neonatal health⁽²⁷⁾.

Research Question: Can foot reflexology massage effective in stabilizing the physiological parameters in preterm neonates?

Methods

Study Design and Setting

A quasi-experimental study was implemented at NICU of Bint Al-Huda Teaching Hospital, which is the biggest governmental pediatric hospital in Thi-Qar Governorate in Al-Nasiriyah City, Iraq. The study period was between May 3rd to September 15th, 2025.

Study Sample and Sampling

A non-probability purposive sample consist of 90 preterm neonates who admitted to NICU, they allocated into two groups, (45) neonates in each group.

Sample Size Calculation

The minimum sample size is 90 preterm neonates according to the calculation of the minimal sample size based on 95% a confidence level and 0.05 margin of error⁽²⁸⁾. They were allocated to either the intervention (n=45) or control group (n=45) to detect physiological differences between groups which are clinically meaningful as shown in (figure1).

Data Collection and Study Instruments

The data was collected by direct observation by the researcher with the co-observer assistance. The parameters were measured at the same time by the same tool on the same preterm. Before the intervention by massage therapy, the researcher was trained for two weeks on applying foot massage therapy under supervision of physiotherapist at the physiotherapy unit in Bint Al-Huda Teaching Hospital.

After get the consent of parent from each preterm, the objective and the benefit were described for them. The researcher applies the session of the massage on the feet of preterm for 20 minutes, after they complete the require routine morning exam, feeding, and investigation. The session of massage was

applying two time daily for continuous three days. There was no recorded any abnormal responses in preterm during massage therapy during process of the study. The heart and oxygen saturation were recorded and measured by the hospital Pulse Oximeter, while the respiratory rate measured manually for one full minute.

Participants were included if They were preterm with gestational age between 30-37 weeks, hemodynamically stable, with no major congenital anomalies. The excluded criteria were preterm with severe respiratory distress, have skin lesions on their feet, Parental refusal or withdrawal of consent.

The researcher utilizes the related literature to develop a structured questionnaire format that derived from the studies that used massage therapy on neonates (22,23). The study instrument consists of the following two parts: socio-demographic data of preterm to obtain the essential descriptive data of the participants in the study. These data included (gestational age, sex, neonate's age, weight at birth, weight on admission, feeding method). Part II was the Physiological Parameters Assessment Form, which included a format to measure preterm: Heart rate, Respiratory rate, and Oxygen saturation. These measures were recorded before and after each session of message.

Ethical Considerations

The study protocol received approval from the Committee of Scientific Research Ethics at the College of Nursing, University of Baghdad, Iraq on March 10th, 2025. Ethical approval code, Ref:28, Date: 10\3\2025. Additional authorization was obtained from Thi-Qar Health Department and Bint Al-Huda Teaching Hospital administration. The study was registered with the Iranian Registry of Clinical Trials (IRCT20250410065277N1) on April 14th, 2025.

Data Analysis

The Statistical Package for Social Sciences (SPSS) version 26 was employed to analyze the data. Descriptive statistics including frequencies, percentages, means, and standard deviations were calculated for demographic variables. The Levene's test assessed homogeneity of variance for demographic characteristics between groups. Given the non-normal distribution of physiological parameters, the non-parametric Mann-Whitney U test was employed to compare differences between intervention and control groups at pre-test and post-test measurements. Statistical significance was set at $p < 0.05$ for all analyses.

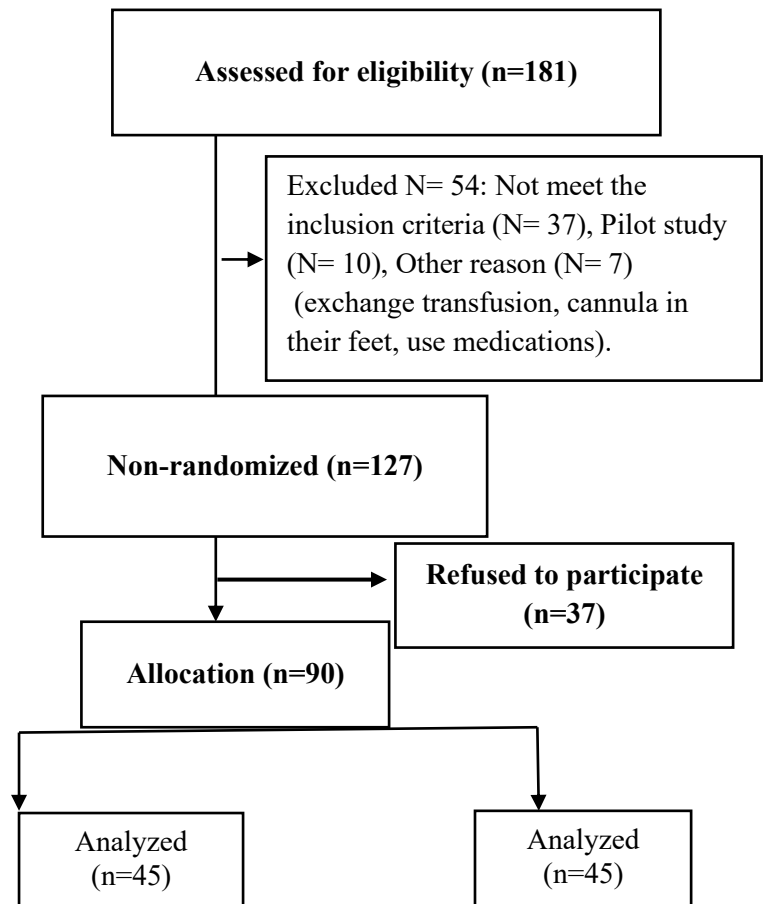


Figure 1. Sampling Process

Results

Table 1. Descriptive of Socio-demographic Characteristics of Participants

No.	Characteristics		Study group		Control group		Variance test
			F	%	f	%	
1	Gestational age (weeks)	30 – 31	6	13.3	6	13.3	Λ= .055 P= .815 Sig= N.S
		32 – 33	13	28.9	10	22.2	
		34 – 36	26	57.8	29	64.4	
		M ± SD	33.67 ± 1.809		33.96 ± 1.870		
2	Sex	Male	24	53.3	27	60	Λ= 1.342 P= .250 Sig= N.S
		Female	21	46.7	18	40	
3	Neonatal age (Days)	2	9	20	15	33.3	Λ= 3.827 P= .054 Sig= N.S
		3	25	55.6	17	37.8	
		4	11	24.4	13	28.9	
		M ± SD	2.09 ± .307		2.96 ± .796		
4	Weight at birth (Kg)	1.5 – ≤ 2	13	28.9	12	26.7	Λ= .786 P= .378 Sig= N.S
		2.1 - ≤ 2.5	27	60	26	57.8	
		2.6 - ≤ 3	5	11.1	7	15.6	
		M ± SD	33.67 ± 1.809		2.13 ± .309		
5	Weight on admission	1.5 – ≤ 2	19	42.2	13	28.9	Λ= .849 P= .360 Sig= N.S
		2.1 - ≤ 2.5	22	48.9	28	62.2	
		2.6 - ≤ 3	4	8.9	4	8.9	
		M ± SD	2.04 ± .298		2.08 ± .294		
6	Feeding method	Breast	5	11.1	4	8.9	Λ= 3.879 P= .052 Sig= N.S
		Bottle	23	51.1	30	66.7	
		Mixed	17	37.8	11	24.4	

No= Number, f= Frequency, %= Percentage, Λ = Levene's Test, P= Probability value, Sig= Significance, N.S= Not significant, S= Significant

Table 1 presents the demographic characteristics of study participants. The two groups were well-matched with no significant differences in baseline characteristics. The majority of neonates in both groups had gestational ages between 34-36 weeks (57.8% intervention vs. 64.4% control), with mean gestational ages of 33.67 $\pm$ 1.81 weeks and 33.96 $\pm$ 1.87 weeks, respectively ($p=0.815$). Male neonates predominated in both groups (53.3% intervention vs. 60.0% control; $p=0.250$). The mean postnatal age at enrollment was 2.09 $\pm$ 0.31 days for the intervention group and 2.96 $\pm$ 0.80 days for the control group, approaching but not reaching statistical significance ($p=0.054$).

Birth weights were similarly distributed, with most neonates weighing between 2.1-2.5 kg (60.0% intervention vs. 57.8% control; $p=0.378$). Admission weights showed comparable distributions (mean: 2.04 $\pm$ 0.30 kg intervention vs. 2.08 $\pm$ 0.29 kg control; $p=0.360$). Bottle feeding was the most common feeding method in both groups (51.1% intervention vs. 66.7% control), followed by mixed feeding (37.8% vs. 24.4%), with breastfeeding being least common (11.1% vs. 8.9%; $p=0.052$).

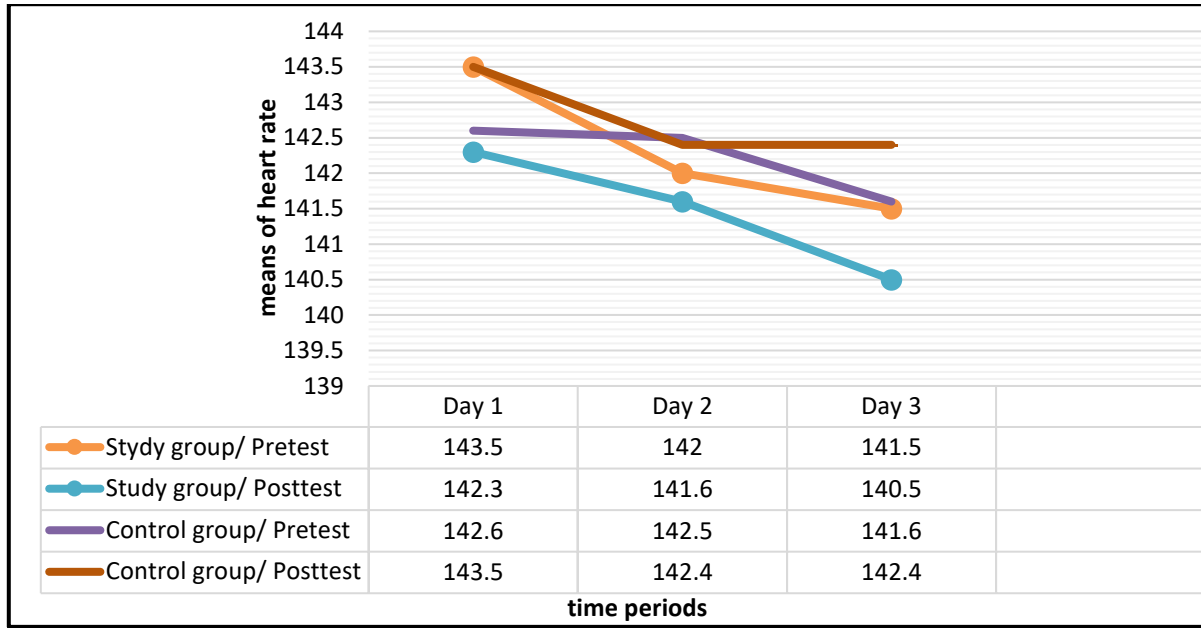


Figure 2. A Line Graph of the Means Score of Preterm Heart Rate Per Minute in Both Groups During Study Measurement Periods

This figure clearly labels the (Intervention vs. Control) lines. It manifests the gradual reduction of the heart rate HR mean within the three-day of foot reflexology intervention period. The intervention group had regular decrease in HR from day1 to day3 indicating more stable autonomic regulation. The control group, however, showed little change may vary over time. But this development was not significant at post-test-level even if the clinical loading seems to point towards a tendency of stabilization.

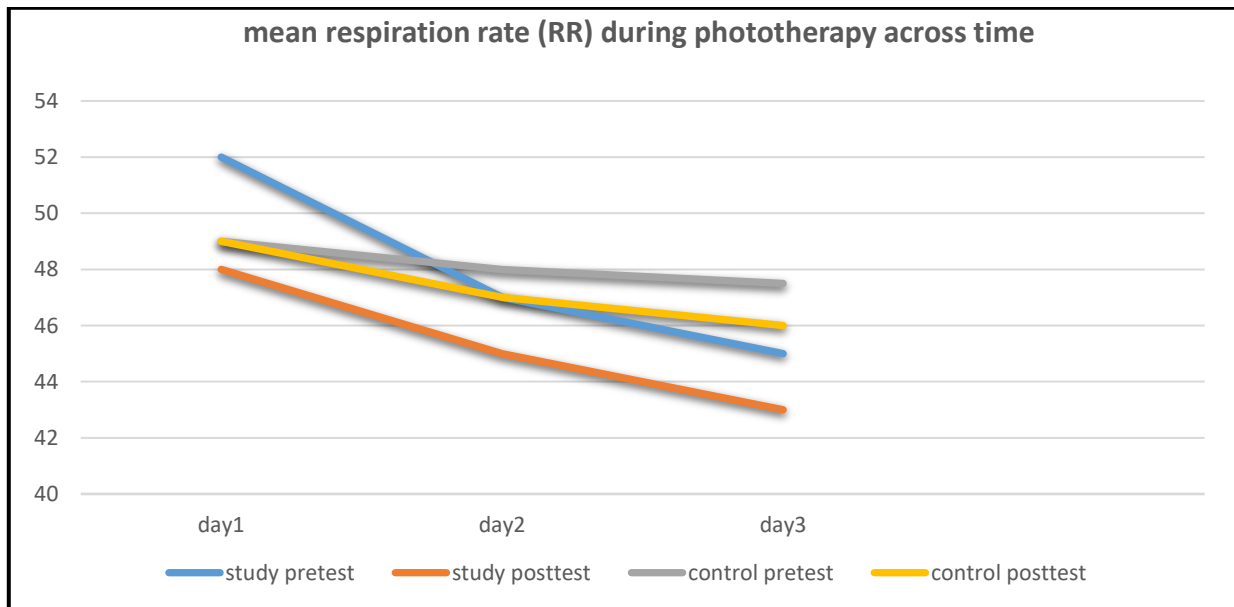


Figure 3. A Line Graph of the Means Score of Preterm Breaths Per Minute in Both Groups During Study Measurement Periods

Figure 3 displays respiratory rate changes over time. The intervention group showed a progressive and consistent decline in respiratory rate from Day 1 through Day 3, indicating improved respiratory stability and adaptation. The control group demonstrated comparatively smaller reductions. This improvement confirming beneficial effect of foot reflexology on respiratory function.

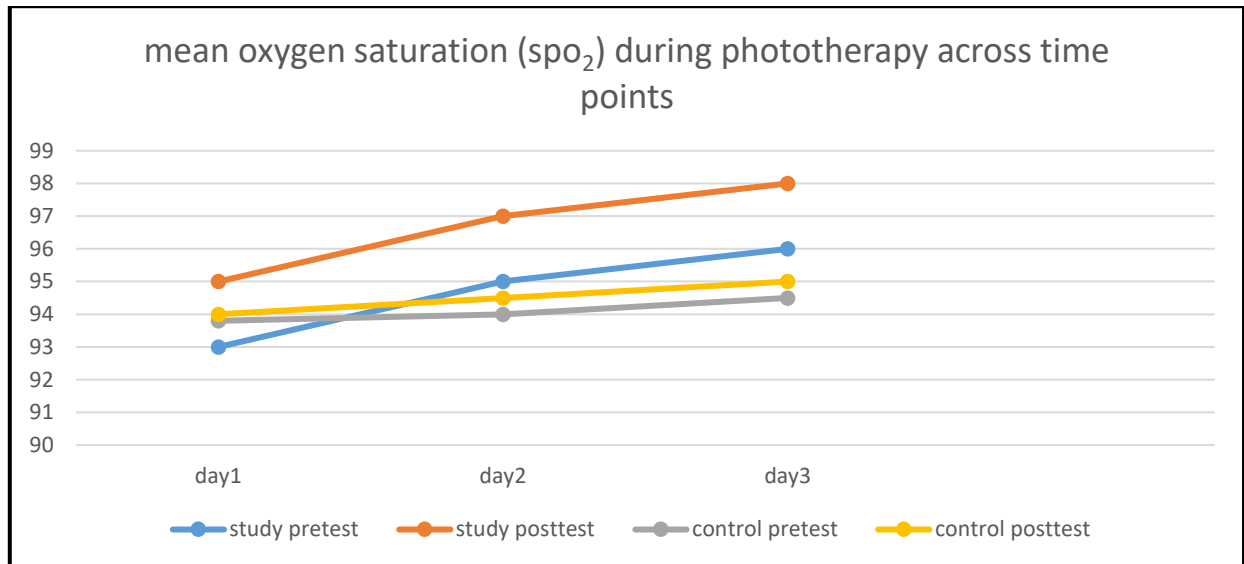


Figure 4. A Line Graph of the Means Score of Preterm Oxygen Saturation Per Minute in Both Groups During Study Measurement Periods

Figure 4 illustrates the trend of oxygen saturation over the period of intervention. The intervention group showed a gradual and consistent rise in SpO₂ from Day 1 to Day 3, signifying improvement in oxygenation status. The control group did demonstrate modest improvement as well, however much shallower overall.

Table 2. Significant Difference in Parameters Scores among Study and Control Groups

Parameter	Time Intervention	Pretest						Posttest					
		N	Mean Rank	Mann-Whitney U	Z-score	p-value	Sig.	N	Mean Rank	Mann-Whitney U	Z-score	p-value	Sig.
HR	Study	45	46.91	949.000	-.514	.607	N.S	45	42.57	880.500	-1.058	.286	N.S
	Control	45	44.09					45	48.43				
RR	Study	45	47.98	901.000	-.904	.366	N.S	45	32.59	431.500	-4.714	.001	S
	Control	45	43.02					45	58.41				
SpO ₂	Study	45	37.83	667.500	-2.833	.005	S	45	65.96	92.000	-7.576	.001	S
	Control	45	53.17					45	25.04				
	Control	45	45.10					45	49.04				

N= Number, p= Probability, Sig= Significance, N.S= Not Significant

Table 2 presents the comparative analysis of physiological variables in both study and control groups at pre- and post-tests. As for heart rate, no statistically significant differences were found between groups at any time point ($p = 0.607$ in pre-test and $p = 0.286$ in post-test), as well as the mean rank of the intervention group was a bit higher than those in control group though being not statistic favorable. However, at pre-post-test, the respiratory score showed no significant difference at pre-test ($p = 0.366$) but indicated highly significant change at post-test ($p = 0.001$) with intervention group recording lower mean ranks ⁽²⁹⁾, suggesting less erratic respiratory patterns following reflexology. Oxygen saturation showed statistically significant differences at pre ($p = 0.005$) and post-test ($p = 0.001$). Especially, intervention group had a significant mean rank score improve dances (pre-test 37.83 to post-test 65.96) but control group scored decreased (pre-test 53.17to post-test 25.04), It is considered that foot reflexology was substantially effective with the oxygenation improvement: effects throughout study duration.

Discussion

This research provides empirical evidence supporting the influence of foot reflexology on physiological parameters in preterm neonates, particularly oxygen saturation and respiratory rate (RR). These findings contribute to the growing body of literature supporting non-pharmacological, supportive interventions in the NICU.

The socio-demographic characteristics of the study population showed a mean gestational age (GA) of approximately 34 weeks, which is consistent with findings from other studies reporting mean GAs of 33.5 ± 1.8 and 34.1 ± 2.0 in their respective groups^(30, 31). Male preterm neonates predominated in both groups (53.3% and 60%), which aligns with a study conducted in Iran reporting 52% male participants⁽³²⁾. This finding is also consistent with Mizal and Mohammed⁽³³⁾, who reported that more than half of their sample (64.0%) were male.

Most neonates were enrolled at 3 days of age, which corresponds with the findings of Mahdy et al.⁽³⁴⁾ in Egypt, where 80–83% of participants were aged 1–3 days. Similarly, a study conducted in Iraq reported that approximately 76.3% of neonates were admitted during the first week of life⁽³⁵⁾. This timing allows for initial stabilization while still addressing early physiological challenges. Bottle feeding was predominant in both groups (51.1% and 66.7%), consistent with findings from Egypt indicating that 83.3% of neonates received bottle feeding⁽³⁶⁾.

The current study demonstrated that foot reflexology led to notable improvements in oxygen saturation and respiratory rate, with favorable trends observed in heart rate stability. The gradual improvement over the three-day intervention period suggests that the effect of reflexology is cumulative rather than immediate.

The significant improvements observed in SpO₂ ($p=0.001$) and respiratory rate ($p=0.001$) in the intervention group support the study hypothesis that foot reflexology enhances cardiorespiratory stability in preterm neonates. These findings are consistent with Elsayed et al.⁽³⁷⁾, who reported increased arterial oxygen saturation and reduced pulse rate following reflexology. Similarly, Düken et al.⁽³⁸⁾ found that preterm infants receiving reflexology exhibited more stable heart rates and higher oxygen saturation compared to controls.

However, it is important to note that a statistically significant difference in pre-test oxygen saturation (SpO₂) was observed between the intervention and control groups, which represents a potential confounding factor. This baseline imbalance may have influenced the post-intervention outcomes, as neonates with higher initial oxygen saturation could demonstrate better physiological responses independent of the intervention. Therefore, the observed improvements in SpO₂ should be interpreted with caution. Future studies are recommended to ensure baseline equivalence between groups or to apply statistical adjustments, such as analysis of covariance (ANCOVA), to control for this potential confounder.

The proposed mechanism underlying these improvements may involve stimulation of the vagus nerve through pressure applied to the solar plexus reflex point. Increased vagal activity promotes parasympathetic dominance, resulting in relaxation, reduced sympathetic overactivity, and improved coordination between respiratory and cardiovascular functions⁽¹³⁾. This neuro-autonomic modulation may be particularly beneficial for premature infants with immature regulatory systems.

These findings are consistent with Jazayeri et al.⁽²³⁾, who reported improved clinical

outcomes following reflexology. Another study also demonstrated a reduction in respiratory rate (46.20 ± 5.52 vs 44.13 ± 4.36 breaths/min) after reflexology intervention ⁽²²⁾, supporting the present results.

Heart rate showed a decreasing trend ($p=0.286$), indicating a more favorable autonomic response; however, the difference was not statistically significant. This finding contrasts with a study conducted in Iran that reported significant post-intervention changes in heart rate ⁽³⁹⁾. The lack of statistical significance in the present study may be attributed to several factors, including the short duration of the intervention (three days), individual variability in autonomic responsiveness, and the relatively small sample size.

Shawq et al. ⁽³⁰⁾ reported significant physiological improvements following music therapy ($p < 0.01$), suggesting that non-pharmacological interventions can influence neonatal physiological stability, although the magnitude of effect may vary depending on the intervention type and duration.

It is noteworthy that the present findings are consistent with a quasi-experimental study conducted in Ardabil, which reported no significant difference in heart rate between intervention and control groups ⁽⁴⁰⁾. This may indicate that while reflexology can positively influence cardiac stability, its effects on oxygen saturation and respiratory rate are more pronounced and consistently observable.

Limitations

Some limitations need to be considered: the single institution study and the lack of randomization in sampling process, which reflect on the current findings that might not be generalized. The evaluation of foot reflexology did not monitor the developmental advantages on long time.

Conclusion

The results of this work confirm the efficacy of foot reflexology in stabilizing physiological parameters among preterm infants. In particular, the intervention led to significant increases in oxygen saturation and respiratory rate. Although HR tended to indicate desired stability.

The gradual gains with increasing intervention days imply that foot reflexology has a cumulative impact on autonomic modulation and cardiorespiratory synchronization. Further studies need to understand these neuro-autonomic pathways and development of optimal intervention protocol and long-term neurodevelopmental outcomes.

Recommendations

Using foot reflexology as a complementary approach, especially for those experiencing respiratory oxygen desaturation. Development of parent education programs to teach safe and effective foot reflexology practice.

Acknowledgment

The author would like to thank all involved participants for their participation in this study.

Funding

None.

Conflicts of interest

The authors report no conflicts of interest in this work.

Availability of data and materials

The datasets used during the current study are available from the corresponding author upon reasonable request.

References

1. Shamkhi HA, Shawq AH. Positioning Preterm Newborns for Cardiorespiratory Stability: A Global Insight. *Academia Open*. 2024;9(2):10-21070. <https://doi.org/10.21070/acopen.9.202>

- 4.9063
2. AL-Mukhtar SH, Abdulghani MF. Knowledge of mothers regarding premature baby care in Mosul city. *Mosul Journal of Nursing*. 2020 Jul 1;8(2):108-18.
<https://doi.org/10.33899/mjn.2020.165620>
3. Nayef aqeel, Neamah M. Evaluation of Nursing Performance Concerning Nasogastric Tube in Neonatal Intensive Care Unit at al-Batool Teaching Hospital in Baqubah City. *Iraqi National Journal of Nursing Specialties (INJNS)*. 2019 Jun. 30 [cited 2025 Oct. 18];32(1):47-5.
<https://doi.org/10.58897/injns.v32i1.323>
4. Hashim Alwan S, Ghanim Ali Ma'ala E. Effectiveness of an Educational Program on Mothers' Attitudes toward Readiness for Discharge Care at Home for a Premature Baby in Intensive Care Unit at Teaching Hospitals in Medical City Complex. *Iraqi National Journal of Nursing Specialties (INJNS)*. 2022 Jan. 6 [cited 2025 Oct. 19];34(2):1-7.
<https://doi.org/10.58897/injns.v34i2.570>
5. Ohuma EO, Moller AB, Bradley E, et al. National, regional, and global estimates of preterm birth in 2020, with trends from 2010: a systematic analysis. *Lancet*. 2023;402(10409):1261-1271.
[https://doi.org/10.1016/S0140-6736\(23\)00878-4](https://doi.org/10.1016/S0140-6736(23)00878-4)
6. Dawood HA, Hameed NN. Effect of oral sucrose in alleviating pain in preterm infants. *Pakistan Heart Journal*. 2023;56(2): 1- 793.
<https://doi.org/Effect of oral sucrose in alleviating pain in preterm infants>
7. Zivaljevic J, Jovandaric MZ, Babic S, Raus M. Complications of preterm birth—The importance of care for the outcome: A narrative review. *Medicina (Kaunas)*. 2024;60(6):1014.
<https://doi.org/10.3390/medicina60061014>
8. Hassan A, Mohamed F, Mohamed N. Effect of different body positions on cardiorespiratory parameters of preterm neonates undergoing mechanical ventilation. *American Journal Nursing Research*. 2020;8(4):463-470.
<http://doi.org/10.12691/ajnr-8-4-6>
9. Patel K, Mutalikdesai S, Chaudhari MT. Effectiveness of conventional care (control group) versus nesting (experimental group) on selected physiological parameters among preterm neonates in NICU. *International Journal of Multidisciplinary Educational Research*. 2021;10(2):1.
10. Shafiei E, Ameri ZD, Sheikhbardsiri H, et al. The Effect of Mother's Lullaby on Preterm Infants' Physiological Indicators. *Journal Pediatric Research*. 2020;7(1):46-51.
<https://doi.org/10.4274/jpr.galenos.2019.88942>
11. Shepherd KL, Wong FY, Odoi A, et al. Prone sleeping affects cardiovascular control in preterm infants in NICU. *Pediatric Research*. 2021;90(1):197-204.
12. Punthmatharith B, Mora J. Effects of positioning on respiration rate, heart rate, and oxygen saturation in preterm infants: a cross-over design. *Pacific Rim International Journal Nursing Research*. 2018;22(3):187-199.
13. Kadhim AJ, Abbasinia M, Abolfazli M, Hezbiyan Z, Dahmardeh H, Aghaie B, Norouzadeh R. A qualitative study to explain the criteria

- of nursing managers in selecting effective nursing diagnosis. *Frontiers of Nursing*. 2024 Dec 1;11(4). DOI: 10.2478/FON-2024-0051
14. Mirsadeghi A, Jafari Iraqi I, Mollahadi M. Contributing factors to medication errors among nurses in Iran: a systematic review. *International Journal of Medical Reviews* . 2019;6(3):105-112.
<https://doi.org/10.29252/IJMR-060307>
 15. Hamidi MS, Kadhim AJ, Bahman A. The Effect of Cooling Face Therapy on Recovery from Pain for Patients after Rhinoplasty: A Randomized Controlled Clinical Trial. *Iraqi National Journal of Nursing Specialties (INJN)*. 2024 Dec. 30 [cited 2025 Oct. 19];37(2):131-8.
<https://doi.org/10.58897/kqkt7d72>
 16. Naseri-Salahshour V, Sajadi M, Abedi A, Fournier A, Saeidi N. Reflexology as an adjunctive nursing intervention for management of nausea in hemodialysis patients: A randomized clinical trial. *Complementary Therapies Clinical Practice*. 2019;36:29-33.
 17. Mohan M, Varghese L. Effect of foot reflexology on reduction of labour pain among primigravida mothers. *International Journal Therapeutic Massage & Bodywork Research* . 2021;14(1):21.
 18. Salia SM, Afaya A, Wuni A, et al. Knowledge, attitudes and practices regarding neonatal jaundice among caregivers in a tertiary health facility in Ghana. *PLoS One*. 2021;16(6):e0251846.
 19. Whatley J, Perkins J, Samuel C. Reflexology: exploring the mechanism of action. *Complementary Therapies in Clinical Practice*. 2022 Aug 1;48:101606.
<https://doi.org/10.1016/j.ctcp.2022.101606>
 20. Miralizadeh A, Peyman A, Jamali Soltani N, Ashktorab T. Comparison of the effect of foot and palm reflexology massage on respiratory distress syndrome in premature infants under noninvasive ventilation. *Complementary Medicine Research*. 2022;29(2):100-108.
<https://doi.org/10.1159/000517982>
 21. Delverdoliny M. The Effect of Massage on the Occurrence of Complications in Premature Infants Admitted to the Neonatal Intensive Care Unit. *Eurasian Journal Chemical Medical and Petroleum Research*. 2024;3(2):323-345.
 22. Badr EA, Ibrahim H. Effect of foot reflexology on neonates' clinical outcomes with hyperbilirubinemia undergoing phototherapy: A randomized controlled trial. *Journal Neonatal Nursing*. 2023;29(2):361-367.
<https://doi.org/10.1016/j.jnn.2022.07.023>
 23. 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. *Complementary Therapies in Medicine*. 2021;59:102684.
 24. Qasem A. Effectiveness of an Intervention Program on Nurses' Performance toward Neonatal Endotracheal Suctioning Procedure. *Iraqi National Journal of Nursing Specialties (INJNS)*. 2022 Dec. 30 [cited 2025 Oct. 19];35(2):82-91.
<https://doi.org/10.58897/injns.v35i2.532>
 25. Abd Ali DK, Al-Hadrawi HH, Al-

- Fayyadh SA, Kamel AM, Al-Zayadi SD. Assessment of validity and reliability of the Arabic nursing core competencies scale-70. *Complementary Therapies Clinical Practice*. 2023;6(2s):207-14.
26. Clayson PE, Carbine KA, Baldwin SA, Larson MJ. Methodological reporting behavior, sample sizes, and statistical power in studies of event-related potentials: Barriers to reproducibility and replicability. *Psychophysiology*. 2019 Nov;56(11):e13437. <https://doi.org/10.1111/psyp.13437>
27. James J, Costello JT, Edwards-Price S, Smith T, McAuley A, Scott BE, Dimitrakoulas S, Edwards M, Kelly D, Wayte DL, Porritt AF. Reflexology specific guidance for using the template for the intervention description and replication (TIDieR): A delphi study. *European Journal of Integrative Medicine*. 2024 Dec 1;72:102416. <https://doi.org/10.1016/j.eujim.2024.102416>
28. Serdar CC, Cihan M, Yücel D, Serdar MA. Sample size, power and effect size revisited: simplified and practical approaches in pre-clinical, clinical and laboratory studies. *Biochemia medica*. 2021 Feb 15;31(1):27-53. <https://doi.org/10.11613/BM.2021.010502>
29. Jing Y, Liu S, Pan C, Jian Y, Wang M, Ni B. The Effects of Foot Reflexology on Vital Signs: A Meta-Analysis of Randomized Controlled Trials. *Evidence-Based Complementary and Alternative Medicine*. 2022;2022(1):4182420. <https://doi.org/10.1155/2022/4182420>
30. Shawq AH, Al-Musawi KM, Kalel MJ, Mahmod AA. The Effects of Music Interventions on Children's Pain Severity and Anxiety during Dressing Changes in Iraq: A Randomized Controlled Trial. *Jurnal Keperawatan Soedirman*. 2025 Mar 26;20(1):43-50. <https://doi.org/10.20884/1.jks.2025.20.1.13100>
31. Belpınar A, Yayan EH, Özdemir A. The Effect of Massage and Foot Reflexology on Sleep in Newborns. *Biological Research for Nursing*. 2025. <https://doi.org/10.1177/10998004251332911>
32. Nikzad N, Kazemi M, Abdoli F. Comparing the effect of foot reflexology and massage therapy on serum bilirubin levels in neonates with hyperbilirubinemia treated with phototherapy: a randomized clinical trial. *J Mazandaran University Medical Sciences*. 2021;31(200):61-72.
33. Mizal AA, Mohammed AQ. Comparison of sleep quality between outpatient and hospitalized children with respiratory tract dysfunction. *Current Problems in Cardiology*. 2024 Aug1;49(8):102639. <https://doi.org/10.1016/j.cpcardi.2024.102639>
34. Mahdy NM, Abed El Kreem HE, Mohamed NT, Abdel Aziz SM. Effect of Foot Reflexology on Physiological Index for Neonates with Hyperbilirubinemia at Neonatal Intensive Care Unit. *Assiut Scientific Nursing Journal*. 2023;11(40):240-249. <https://doi.org/10.21608/asnj.2024.249869.1716>
35. Shaker N. Disease Patterns and outcomes of Neonatal Admissions at Raparin Pediatric Teaching Hospital in Erbil City. *Iraqi National Journal of*

- Nursing Specialties (INJNS). 2015 Dec. 30 [cited 2025 Oct. 19];28(2):39-46.
<https://doi.org/10.58897/injns.v28i2.228>
36. Ibrahim Mabrouk Baraka N, Reda Ali El-kest H, Abdl elsalam Mohamed Elwan S. Effect of Foot Massage and Acupressure on Pain Levels and Physiological Parameters during Heel Lancing in Full-Term Neonates. International Egyptian Journal of Nursing Sciences and Research. 2022;3(1):133-145.
<https://doi.org/10.21608/ejnsr.2022.247068>
37. Elsayed AE, Kandeel NA, Abd El-Aziz WW. The effect of foot reflexology on physiological indicators and mechanical ventilation weaning time among open-heart surgery patients. American Journal of Nursing Research. 2019;7(4):412-419.
38. Düken ME, Yayan EH, Arslan Z. The effects of massage and white noise on physiological parameters of preterm infants: a randomized controlled research. J Neonatal Nursing. 2024;30(4):360-367.
<https://doi.org/10.1016/j.jnn.2023.11.008>
39. Golitaleb M, Safdari A, Rafiei F, et al. Comparing the impact of foot and hand reflexology on anxiety and physiological indices in colonoscopy candidates: A randomized clinical trial. Contemporary Clinical Trials Communications. 2025;44:101449.
<https://doi.org/10.1016/j.conctc.2025.101449>
40. Samadi N, Allahyari I, Mazaheri E, et al. Effect of foot reflexology on physiologic index of neonates. Iranian Journal of Neonatology. 2014;5(1):19-22.