



# Effectiveness of Massage Therapy with and Without Oil on Neonatal Weight and Serum Triglycerides: A Randomized Clinical Trial

Ali Naseh <sup>1</sup>, Neda Massomi <sup>2</sup>, Narges Gholami <sup>3,\*</sup>, Shirin Mohamadi <sup>4</sup>, Zahra Khodaghohi <sup>5</sup> and Elahe Rastkar Mehrabani <sup>1</sup>

<sup>1</sup>Clinical Research and Development Center, Mahdihyeh Educational Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran

<sup>2</sup>Department of Pediatrics, Shahid Beheshti University of Medical Sciences, Tehran, Iran

<sup>3</sup>Loghman Hakim Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran

<sup>4</sup>Department of Neonatology, Shahid Beheshti University of Medical Sciences, Tehran, Iran

<sup>5</sup>Shahid Beheshti University of Medical Sciences, Tehran, Iran

\*Corresponding author: Assistant Professor of Pediatrics, Loghman Hakim Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran. Email: [nargesgholami724@yahoo.com](mailto:nargesgholami724@yahoo.com)

Received 2022 August 01; Revised 2022 November 21; Accepted 2023 January 11.

## Abstract

**Background:** Low birth weight among preterm neonates is a crucial public health problem worldwide.

**Objectives:** The study aimed to assess if massage therapy and coconut oil application could affect weight gain in premature neonates.

**Method:** A double-blind, randomized controlled trial (RCT) was conducted in neonatal intensive care units (NICU) of 2 educational hospitals affiliated with Shahid Beheshti University of Medical Sciences, Tehran, Iran, from September 2019 to April 2021. Massage therapy, alongside applying coconut oil to the skin for 5 days, versus massage therapy with tepid water, was considered an intervention. Demographic data, weight gain, and serum triglycerides (TG) levels were the outcomes. First, oil was tested on the baby's wrist skin. If there was no skin reaction or side effects, massage therapy was started using fingertips in 3 steps, and each step lasted for 5 minutes.

**Results:** The study included 94 neonates with a gestational age of fewer than 37 weeks who were randomly assigned to 3 groups: body massage with coconut oil group (n = 33), body massage without oil (n = 30), and control group (n = 31) who did not receive any intervention. Fifty-one cases (54.3%) were male. The mean gestational age of all patients was  $32.5 \pm 2.24$  weeks (range of 27 to 36.6), birth weight was  $1769.04 \pm 472.8$  grams (range of 800 to 2780 grams), serum triglycerides levels before and after intervention in all patients were  $0.87 \pm 0.43$  and  $1.14 \pm 0.50$  mmol/L respectively (or  $77.04 \pm 39.7$  and  $100.94 \pm 44.7$  mg/dL respectively) ( $P = 0.44$ ). The 5-day average weight gains based on the groups included: coconut oil:  $49.24 \pm 94.32$  grams, tepid water:  $27.16 \pm 65.79$  grams, control:  $26.29 \pm 77.09$  grams,  $P = 0.49$ . There were no statistically significant differences among all groups for weight gain and change in serum TG levels.

**Conclusions:** Massage therapy, alongside applying coconut oil to the skin for 5 days, could not increase weight and serum TG levels in premature neonates. Further studies with long-term intervention and a larger sample size are recommended.

**Keywords:** Neonatal, Randomized Controlled Trial, Massage Therapy, Coconut Oil

## 1. Background

Low birth weight among preterm neonates is a crucial public health problem worldwide, and it has an increasing rate in almost all countries. Furthermore, preterm birth occurs more often in lower-income countries (1).

Preterm delivery before 37 weeks of pregnancy causes more than half of the morbidity and mortality of the infancy period. Moreover, the preterm care strategy has a more significant role in saving premature babies (2, 3).

Despite improvements in the quality of care provided to premature infants in recent decades, proper weight gain

is still a main concern for their health and survival.

Thermal care, skin-to-skin contact (SSC), Kangaroo mother care (KMC), and proper nutrition have been introduced for weight gain improvement in premature babies. Bathing with or without a skin-cleaning agent is safe in neonates' care (4-6).

In addition, some researchers have demonstrated that touch or massage therapy has positive effects on heart rate, respiratory rate, sleep time, growth and neurodevelopment index, skin health, immune system, bone density, vagal activity, gastric motility, insulin levels, and insulin-

like growth factor (IGF1) (7).

Since thousands of years ago, in several Asian countries like China and India, a traditional practice of performing massage alongside applying emollients to the skin has been used for neonates to encourage better growth and weight gain. For this purpose, some oil is usually used for neonatal body massage (8).

Generally, oils are composed of great amounts of fatty acids with varying degrees of chain lengths. The skin absorption of some oils, such as coconut and sunflower oils, which contain lauric acid, linolenic acid, and arachidonic acid, has anti-inflammatory and beneficial nutritional properties that maintain skin integrity and decrease insensible water loss (9).

## 2. Objectives

Considering that there are limited studies about the effects of oil absorption on serum triglycerides (TG) levels in preterm neonates (10), we aimed to study the effects of massage therapy with and without oil on weight gain and serum triglycerides levels in preterm neonates.

## 3. Methods

This double-blind, randomized controlled trial (RCT) was conducted to evaluate the effects of massage therapy with and without coconut oil on neonates' body weight and serum triglyceride levels. Neonates were enrolled in the study after recovery from any serious disease. The duration of the study was 5 days.

### 3.1. Participants

Neonates with a gestational age of fewer than 37 weeks were enrolled in this study. Ninety-four neonates were divided into 3 groups. Alongside routine neonatal intensive care units (NICU) care, the intervention happened in 2 groups, including a group receiving massage with coconut oil ( $n = 33$ ) and the next group receiving massage without oil and rather with tepid water ( $n = 30$ ). The third group was the control group ( $n = 31$ ).

Exclusion criteria included: having any serious medical condition such as respiratory or cardiac disease, skin lesions, severe sepsis, total parenteral (TPN) or intralipid therapy, life-threatening abnormalities or anomalies. A study's loss-of-follow-up criteria also included patients whose parents had not agreed to participate in the study, neonates discharged early or transferred to another center, newborns with serious health problems, deaths, and skin reactions during the intervention. Neonates entered the study when they had somehow a stable condition and had

at least 60 kcal/kg intake daily orally or through gavage. However, considering their IV administration, their total intake was at least 120 kcal/kg/day. Daily weight gains of 15 g/kg/day in premature infants receiving 120 kcal/kg/day were considered adequate (11).

Parents completed an informed consent form. Figure 1 illustrates the study protocol.

This study was performed in the NICU of 2 educational hospitals affiliated with Shahid Beheshti University of Medical Sciences, Tehran, Iran, from September 2019 to April 2021.

Demographic information such as gestational age, calendar age, sex, birth weight, height, head circumference, daily weight, delivery method, maternal age, premature comorbidities (respiratory distress syndrome or RDS, sepsis, intraventricular hemorrhage), and serum triglycerides levels (on the first and on the fifth day of intervention) were recorded.

A speech therapist and a nurse were trained to massage the neonates according to the massage techniques booklet for babies, which is available in Iran (<https://www.newsha.ir/product>). Neonatal and Infant Massage, Neonatal Health Department of the Ministry of Health and Medical Education, Pajhwok Arman).

In intervention groups, the massage therapist performed a 15-minute massage twice daily for 5 days at 9 AM and also at 1 PM. In the first intervention group, body massage was applied with coconut oil, and in the second one, massage was applied with tepid water.

The intervention was conducted at least one hour after feeding. The patient was placed in a prone position under the warmer, and the appropriate diaper was worn. Body temperature, heart rate, respiration rate, and O<sub>2</sub> saturation were monitored.

### 3.2. Intervention

#### 3.2.1. Massage Therapy with Coconut Oil Group

First, coconut oil was tested on the baby's wrist skin. Massage therapy was started if there was no skin reaction or side effects. Massage therapy was performed in 3 steps:

- (1) Step 1: Touch the head, neck, shoulders, back, thighs, ankles, legs, and hands with her fingertips (5 minutes);
- (2) Step 2: Touch the face and cheeks, chest, abdomen, plantar, and palm areas with her fingertips (5 minutes);
- (3) Step 3: Open and close the joints (passive movements) of the shoulders, elbows, knees, and wrists separately (5 minutes).

#### 3.2.2. Massage Therapy Without Oil Group

All steps were performed similarly to massage therapy with the coconut oil group, but tepid water was applied instead of oil.

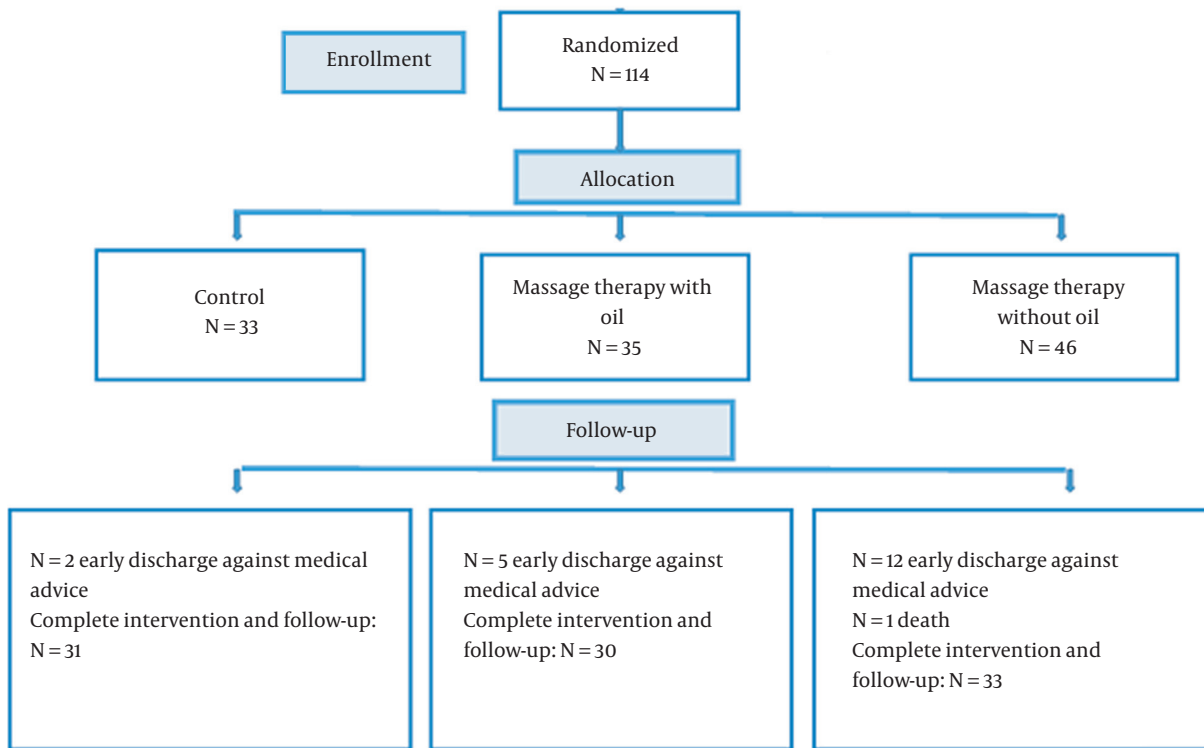


Figure 1. Protocol study

### 3.2.3. Control Group

There was no intervention in the control group.

### 3.3. Sample Size

The sample size was determined by assuming a confidence interval of 95%, a power of 80%, a 2-sided significance level of  $\alpha = 0.05$ , and a loss to follow-up of 20%. Considering an effect size of 3 g/kg/day (10), the sample size was estimated at 22 neonates for each group, although we recruited a higher number of patients. Equal randomization and an allocation ratio of 1:1 were used for the intervention and control groups.

The massage therapists randomized eligible neonates into 3 groups using random number generation (<https://www.random.org>). Birth weight was considered a confounding variable, so normal weight distribution was considered in patients' assignments.

The massage therapists were informed about the groups' division, while the nurse who measured the daily weight and serum TG samples, the researcher who recorded the information, and the statistician who analyzed the data were blind to grouping.

Normally distributed data are presented as the mean and standard deviation. For comparison, Student's *t*-test

and Manne Whitney U test were used for continuous data, and the chi-square test and Fisher's exact test were used for categorical data. SPSS software version 20.0 was used for all statistical analyses. P-value < 0.05 was considered statistically significant.

### 3.4. Ethical Code

The study was approved by the Ethical Committee of Shahid Beheshti University of Medical Sciences (IR.SBMU.MSP.REC.1398.550); also, this clinical trial was registered on the IRCT website (IRCT ID: IRCT20180610040036N3, link: <https://www.irct.ir/trial/63327>).

## 4. Results

In this study, 94 neonates were enrolled and divided into 3 groups.

From neonates, 51 cases (54.3%) were male. There were no statistically significant differences between groups based on sex (P value = 0.9).

The mean gestational age of all patients was  $32.5 \pm 2.24$  weeks (range: 27, 36.6), birth weight was  $1769.04 \pm 472.8$

grams, the birth head circumference was  $29.98 \pm 2.5$  cm, birth height was  $42 \pm 4$  cm, and maternal age was  $31.63 \pm 7.06$  years.

All groups had no statistically significant differences between gestational age, birth weight, or mother's age. Demographic data of all patients are presented in [Table 1](#).

In 84 (89.4%) cases, the neonates were delivered by cesarean section.

Based on the number of babies in pregnancy, 39 cases (41.5%) were single births, 39 cases (41.5%) were twins, 13 cases (13.8%) were triplets, and 3 cases (3.2%) were quadruplets. Sixty-three (67%) mothers had no medical history of diseases.

The most common original causes of patients' admission were prematurity (51.1%), then RDS (38.3%), asphyxia (5.3%), sepsis (2.1%), hydronephrosis (2.1%), and intracranial hemorrhage (1.1%) respectively.

A comparison of weight gain per day in different groups in [Figure 2](#) and the frequency of proper weight gain and neonatal weight during 5 days of this study in [Table 2](#) are presented.

Weight gains during this study were  $49 \pm 94$ ,  $27 \pm 66$ , and  $26 \pm 77$  (grams per day) in the massage therapy with and without oil and control groups, respectively. Although the average weight gain of patients in the massage therapy with coconut oil group was higher than the 2 groups, those numbers did not reach statistical significance (P value = 0.49).

[Table 3](#) presents serum triglyceride levels of patients before and on the fifth day after intervention in all groups. No statistically significant difference was observed between these groups.

There was no skin reaction or adverse effects of oil application and massage therapy in this study.

## 5. Discussion

This study aimed to evaluate the effects of massage therapy with and without coconut oil on premature (gestational age (GA) < 37 weeks) neonates' weight and serum TG level in a 5-day intervention. Our data showed that massage therapy with or without oil has no significant effect on weight gain and serum TG level during 5 days of intervention compared to the control group.

Regarding a systematic review published in 2017, the parameters of the massage therapy protocol for preterm, the average session length of the session was  $15.18 \pm 3.53$  minutes, usually performed 2 - 3 times a day. The total duration of treatment varied from 5 days to 29 days ([12](#)).

Previous studies have shown that preterm infants who received massage therapy for 5 to 10 days had 21 to 48 per-

cent better weight gain and 3 to 6 days less hospitalization than control infants ([13-16](#)).

Moreover, the Elmoneim et al. study has shown that 5 days of massage therapy increased average daily weight gain by 1.5 to 2 times compared to the routine care group ([17](#)).

Therefore, based on the review of the articles and our limitations, equipment, facilities, and securing a better follow-up of patients, 5-day massage therapy were considered when conducting this study.

Previous studies showed that oil application in neonates might promote the skin barrier and decrease the infection rate. Also, massage therapy stimulates the release of IGF1, improves vagal activity, gastric motility, abilities for sucking and feeding, sleep pattern, and finally, better weight gain. Hence, it would improve neonatal health and reduce neonatal morbidities and mortalities ([12-14, 18](#)).

Studies have stated that massage therapy, particularly with oil application, mainly affects growth parameters in neonates ([12, 15, 16](#)).

While this study found that although in massage therapy with the oil group, more weight gain per day was observed, the statistical differences between groups did not reach significance, perhaps due to the small sample size that may cause wide variations in our data.

Saedi et al. reported that massage therapy with medium-chain triglycerides (MCT) oil increased premature neonates' weight gain in a 7-day study ([19](#)). Additionally, Taheri et al. showed that 5 days of massage therapy with sunflower oil improved weight gain in preterm infants ([20](#)).

Also, Yoanita et al. also assessed the 10-day tactile-kinesthetic stimulation effect on babies' growth index and saw improvements in weight gain, length, tone, and reflexes ([21](#)). Other studies supported the same findings ([7, 22](#)).

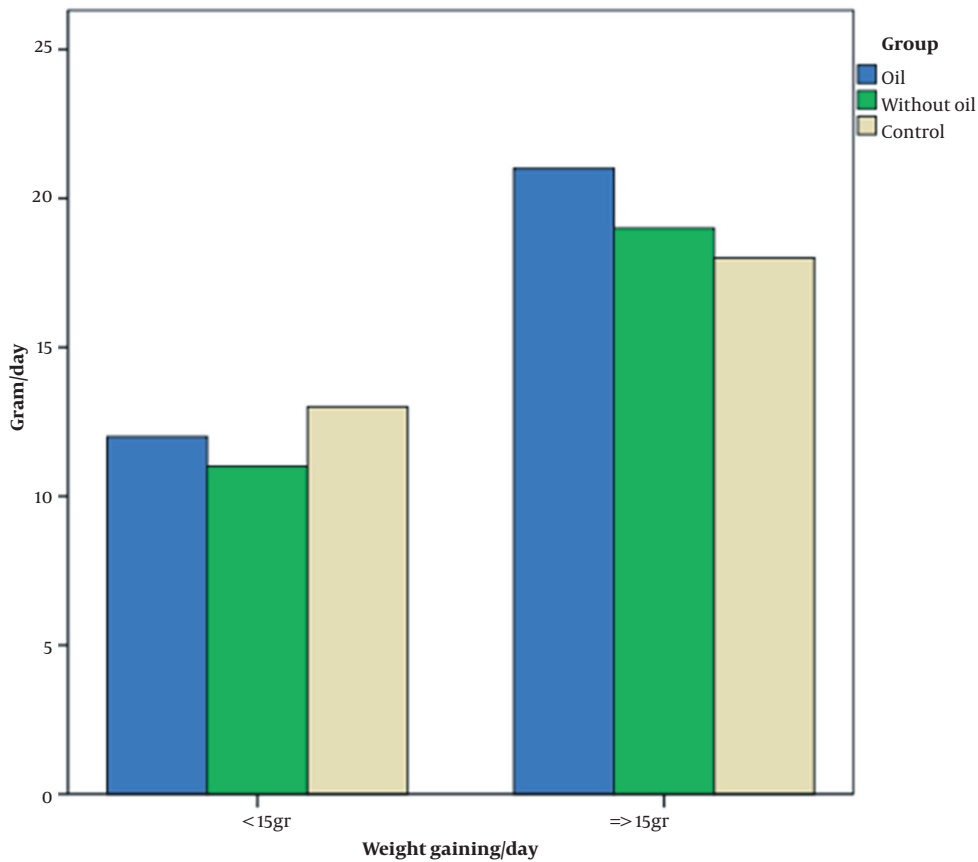
Those contradictory findings suggest that further studies are needed to confirm the positive effects of massage therapy with oil on neonatal weight gain, while its real effects and the adequate duration of intervention remain questionable.

Moreover, our patients had no significant differences in serum TG levels. Also, Kumar et al. reported massage therapy with oil in a 7-day-duration intervention had no significant effect on serum TG levels after 28 days post-intervention ([23](#)). On the other hand, Field et al. described that oil application in premature neonates increased serum TG levels by the transcutaneous absorption of oil ([13](#)). There is a lack of literature on this issue, and further studies with a larger sample size are recommended.

The strengths of this study include its randomized con-

**Table 1.** Demographic Data of Patients in Different Groups (n = 94)

Group	Total, No. (%)	Boy, No. (%)	Girl, No. (%)	Gestational Age (wk)		Birth Weight (g)		Maternal Age (y)	
				Mean ± SD	Min, Max	Mean ± SD	Min, Max	Mean ± SD	Min, Max
<b>Massage therapy</b>									
With oil	33 (35.1)	18 (54.5)	15 (45.5)	32.06 ± 2.08	(28, 36)	1723.64 ± 404.36	(1000, 2600)	34.39 ± 8.07	(22, 57)
Without oil	30 (31.9)	16 (53.3)	14 (46.7)	32.19 ± 2.54	(27, 36)	1710.17 ± 484.95	(800, 2650)	31.2 ± 5.8	(22, 45)
<b>Control</b>	31 (33)	17 (54.8)	14 (45.2)	33.27 ± 1.96	(28.3, 35.5)	1874.35 ± 523.5	(1070, 2780)	29 ± 6.1	(16, 44)
<b>Total</b>	94 (100)	51 (54.3)	43	P value = 0.23		P value = 0.25		P value = 0.73	



**Figure 2.** Comparing weight gain per day in different groups

trolled study design and its evaluation of serum TG levels in premature neonates during the intervention.

The study's limitations include its short course of intervention and its small sample size.

Additionally, the COVID-19 pandemic occurred during our study, and we were confronted with some difficulties and limitations in sample selection and performing massage therapy and patient follow-up.

We recommend performing a long-term evaluation of

massage therapy's benefits or adverse effects, and oil application in neonates is advised.

### 5.1. Conclusions

Massage therapy during 5 days of intervention with and without applying coconut oil to the skin had no significant effect on weight gain and serum TG levels in premature neonates.

**Table 2.** Neonates' Weight in a 5-day Period of Study (n = 94)<sup>a</sup>

Weight/Day	All Groups	Massage Therapy		Control Group	P Value
		With Coconut Oil	Without Oil		
W/1	1698.40 ± 442.62	1630.45 ± 397.47	1663.50 ± 424.68	1804.52 ± 496.54	0.6
W/2	1663.07 ± 439.58	1633.30 ± 399.56	1660.33 ± 405.57	1701.07 ± 524.99	0.26
W/3	1681.83 ± 407.92	1645.15 ± 399.55	1675.17 ± 399.52	1734.07 ± 436.45	0.45
W/4	1702.06 ± 402.98	1655.61 ± 396.61	1683.33 ± 397.83	1779.63 ± 419.95	0.53
W/5	1733.03 ± 422.02	1679.70 ± 408.43	1690.67 ± 399.67	1830.81 ± 452.73	0.40
<b>In 5-day period (g/d)</b>	34.62 ± 80.28	49.24 ± 94.32	27.16 ± 65.79	26.29 ± 77.09	0.49
<b>Total</b>	94	33	30	31	
<b>Weight gaining (g/d)</b>	36 (38.3)	18 (36.4)	11 (36.7)	13 (41.9)	
< 15					
≥ 15	58 (61.7)	15 (63.6)	19 (63.3)	18 (58.1)	

<sup>a</sup> Values are expressed as mean ± SD or No. (%).

**Table 3.** Serum Triglyceride Level (n = 94)<sup>a</sup>

Triglyceride/Day (mg/dL)	All Groups	Massage Therapy		Control Group	P Value in 3 Groups
		With Oil	Without Oil		
<b>TG0 (Before intervention)</b>	77.04 ± 39.73	73.21 ± 32.77	91.53 ± 49.83	67.10 ± 31.91	0.29
<b>TG5 (After intervention)</b>	100.94 ± 44.66	86.97 ± 40.34	112.87 ± 56.86	104.26 ± 30.87	0.23
<b>TG5 - TG0 (TG during study)</b>	23.89 ± 47.91	13.75 ± 47.36	21.33 ± 59.24	37.16 ± 32.08	0.44
<b>Total</b>	94	33	30	31	

Abbreviation: TG, triglyceride

<sup>a</sup> Values are expressed as mean ± SD.

## Acknowledgments

Authors would like to thank Dr. Maryam Khoshnoud Shariati and Dr. Naeme Taslimi Taleghani and all other colleagues and nursing staff at Shohadaye-Tajrish and Mahdiyeh hospitals affiliated with Clinical Research Development Center, Mahdiyeh Educational Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran for their collaboration and help. Authors are thankful to the parents and their neonates who participated in this study.

## Footnotes

**Authors' Contribution:** N. G.: Study concept and design, drafting of the manuscript, analysis, and interpretation of data and administrative, technical, and material support, study supervision; A. N.: Study concept and design, acquisition of data, critical revision of the manuscript for important intellectual content and administrative, technical, and material support, study supervision; N. M., E. R., Z. K. and S. M.: Acquisition of data

**Clinical Trial Registration Code:** this clinical trial was registered on the IRCT website (IRCT id: IRCT20180610040036N3, link: [www.irct.ir/trial/63327](http://www.irct.ir/trial/63327)).

**Conflict of Interests:** Authors are faculty members of Shahid Beheshti University of Medical Sciences

**Data Reproducibility:** The dataset presented in the study is available on request from the corresponding author during submission or after its publication. The data are not publicly available due to we selected this option on the IRCT website, and the corresponding author's email address is available in the article.

**Ethical Approval:** The study was approved by the Ethical Committee of Shahid Beheshti University of Medical Sciences (IR.SBMU.MSP.REC.1398.550).

**Funding/Support:** This research was approved and supported by the Clinical Research & Development Unit (CRDU) of Loghman Hakim Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran (ID: 18902).

**Informed Consent:** Parents completed the informed consent forms.



## References

- Muhe LM, McClure EM, Nigusie AK, Mekasha A, Worku B, Worku A, et al. Major causes of death in preterm infants in selected hospitals in Ethiopia (SIP): a prospective, cross-sectional, observational study. *Lancet Glob Health*. 2019;7(8):e1130–8. [PubMed ID: 31303299]. [PubMed Central ID: PMC6639243]. [https://doi.org/10.1016/S2214-109X\(19\)30220-7](https://doi.org/10.1016/S2214-109X(19)30220-7).
- Victora JD, Silveira MF, Tonial CT, Victora CG, Barros FC, Horta BL, et al. Prevalence, mortality and risk factors associated with very low birth weight preterm infants: an analysis of 33 years. *J Pediatr (Rio J)*. 2020;96(3):327–32. [PubMed ID: 30550758]. [PubMed Central ID: PMC9432241]. <https://doi.org/10.1016/j.jpmed.2018.10.011>.
- Xu F, Kong X, Duan S, Lv H, Ju R, Li Z, et al. Care Practices, Morbidity and Mortality of Preterm Neonates in China, 2013-2014: a Retrospective study. *Sci Rep*. 2019;9(1):19863. [PubMed ID: 31882629]. [PubMed Central ID: PMC6934849]. <https://doi.org/10.1038/s41598-019-56101-x>.
- Defrancq K, MChiro MAPP. Giving birth: a systematic review of the value of skin to skin contact in a medicalized birth. *Journal of Clinical Chiropractic Pediatrics*. 2019;18(2):1591–5.
- Baton S, Villanueva-Uy MET, De Leon-Mendoza S. Effectiveness of Kangaroo Mother Care in Intubated Preterm Neonates 28 to 36 Weeks Gestational Age, Weighing 600 to 2000 Grams at Birth: A Randomized Controlled Trial. *Acta Med Philipp*. 2021;55(9). <https://doi.org/10.47895/amp.v55i9.3751>.
- Siroosbakht S, Aarabi N, Rezakhanlani B. Bathing or Not Bathing: Which Is Better for Umbilical Cord Separation Time and Bacterial Colonization in Neonates? *Arch Pediatr Infect Dis*. 2020;9(2). <https://doi.org/10.5812/pedinfect.104100>.
- Kulkarni A, Kaushik JS, Gupta P, Sharma H, Agrawal RK. Massage and touch therapy in neonates: the current evidence. *Indian Pediatr*. 2010;47(9):771–6. [PubMed ID: 21048258].
- Lauer C. *The Health Benefits of Topical Virgin Coconut Oil for Preterm Infants—Studies Show Why You want to Massage Your Newborn Baby with Coconut Oil*. Bastrop, USA: Coconut Oil; 2019, [updated 22 Jul 2019]. Available from: <https://coconutoil.com/the-health-benefits-of-topical-virgin-coconut-oil-for-preterm-infants-studies-show-why-you-want-to-massage-your-newborn-baby-with-coconut-oil/>.
- Kusari A, Han AM, Virgen CA, Matiz C, Rasmussen M, Friedlander SF, et al. Evidence-based skin care in preterm infants. *Pediatr Dermatol*. 2019;36(1):16–23. [PubMed ID: 30548578]. <https://doi.org/10.1111/pde.13725>.
- Field T. Infant massage therapy research review. *Clinical Research in Pediatrics*. 2018;1(2):1–9.
- Mathew G, Gupta V, Santhanam S, Rebekah G. Postnatal Weight Gain Patterns in Preterm Very-Low-Birth-Weight Infants Born in a Tertiary Care Center in South India. *J Trop Pediatr*. 2018;64(2):126–31. [PubMed ID: 28582577]. <https://doi.org/10.1093/tropej/fmx038>.
- Alvarez MJ, Fernandez D, Gomez-Salgado J, Rodriguez-Gonzalez D, Roson M, Lapena S. The effects of massage therapy in hospitalized preterm neonates: A systematic review. *Int J Nurs Stud*. 2017;69:119–36. [PubMed ID: 28235686]. <https://doi.org/10.1016/j.ijnurstu.2017.02.009>.
- Field T, Diego M, Hernandez-Reif M. Preterm infant massage therapy research: a review. *Infant Behav Dev*. 2010;33(2):115–24. [PubMed ID: 20137814]. [PubMed Central ID: PMC2844909]. <https://doi.org/10.1016/j.infbeh.2009.12.004>.
- Ghosh D, Mani S, Datta P. Use of Coconut Oil Massage versus Olive Oil Massage on Selected Physical and Physiological Parameters among Low Birth Weight Newborns in Selected Hospitals, in West Bengal. *Indonesian Journal of Global Health Research*. 2019;2(4). <https://doi.org/10.37287/ijghr.v2i4.303>.
- Darmstadt GL, Khan NZ, Rosenstock S, Muslima H, Parveen M, Mahmood W, et al. Impact of emollient therapy for preterm infants in the neonatal period on child neurodevelopment in Bangladesh: an observational cohort study. *J Health Popul Nutr*. 2021;40(1):24. [PubMed ID: 34039435]. [PubMed Central ID: PMC8152128]. <https://doi.org/10.1186/s41043-021-00248-9>.
- Jamshaid AA, Hamid MH, Fatima T, Noor M, Wasim A. Emollient Therapy in Preterm & Low Birth Weight Neonates: A Randomised Clinical Trial. *J Coll Physicians Surg Pak*. 2021;31(3):298–301. [PubMed ID: 33775019]. <https://doi.org/10.29271/jcpsp.2021.03.298>.
- Elmoneim MA, Mohamed HA, Awad A, El-Hawary A, Salem N, El Helaly R, et al. Effect of tactile/kinesthetic massage therapy on growth and body composition of preterm infants. *Eur J Pediatr*. 2021;180(1):207–15. [PubMed ID: 32666281]. <https://doi.org/10.1007/s00431-020-03738-w>.
- Kiechl-Kohlendorfer U, Berger C, Inzinger R. The effect of daily treatment with an olive oil/lanolin emollient on skin integrity in preterm infants: a randomized controlled trial. *Pediatr Dermatol*. 2008;25(2):174–8. [PubMed ID: 18429773]. <https://doi.org/10.1111/j.1525-1470.2008.00627.x>.
- Saeadi R, Ghorbani Z, Moghaddam A. The effect of massage with medium-chain triglyceride oil on weight gain in premature neonates. *Acta Med Iran*. 2015:134–8.
- Taheri PA, Goudarzi Z, Shariat M, Nariman S, Matin EN. The effect of a short course of moderate pressure sunflower oil massage on the weight gain velocity and length of NICU stay in preterm infants. *Infant Behav Dev*. 2018;50:22–7. [PubMed ID: 29126078]. <https://doi.org/10.1016/j.infbeh.2017.11.002>.
- Yoanita R, Gunardi H, Rohsiswatmo R, Setyanto DB. Effect of tactile-kinesthetic stimulation on growth, neurobehavior and development among preterm neonates. *J Bodyw Mov Ther*. 2021;28:180–6. [PubMed ID: 34776139]. <https://doi.org/10.1016/j.jbmt.2021.06.023>.
- Abedi F, Mirbagher Ajorpaz N, Esalatmanesh S, Rahemi Z, Gilasi HR, Kafaei Atrian M, et al. The effect of tactile-kinesthetic stimulation on growth indices of healthy neonates. *J Bodyw Mov Ther*. 2018;22(2):308–12. [PubMed ID: 29861224]. <https://doi.org/10.1016/j.jbmt.2017.08.005>.
- Kumar J, Upadhyay A, Dwivedi AK, Gothwal S, Jaiswal V, Aggarwal S. Effect of oil massage on growth in preterm neonates less than 1800 g: a randomized control trial. *Indian J Pediatr*. 2013;80(6):465–9. [PubMed ID: 23054851]. <https://doi.org/10.1007/s12098-012-0869-7>.