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The Effect of Massage on Growth in Premature Babies: A Systematic Review and Meta-Analysis

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Abstract

Background: Massage is one of the applications that has a positive effect on the growth of premature babies. The aim of this study is to examine the effect of massage on growth in premature babies.

Methods: In this systematic and meta-analysis study, Academic Search Complete (EBSCOHOST), Medline, Web of Science, Nursing & Allied Health Database-ProQuest, Pubmed, and Science Direct databases were explored in order to determine the studies on the effect of massage on growth in premature babies between 2000 and 2020. Six studies were included in the systematic review and meta-analysis.

Results: A total of 308 premature babies were included in this systematic review and meta-analysis. It was found that the head circumference (MD: 0.97, 95% CI: min: 0.73, max: 1.21, $P < .001$) and total weight gain (MD: Mean difference 129.09, 95% CI: min: 79.58, max: 178.60, $P < .001$) of the babies in the massage group are statistically significantly higher than the infants in the control group.

Conclusions: It was concluded that massage increased head circumference and total weight gain in premature babies but did not affect the length and daily weight gain. There is a need for more randomized controlled studies in order to examine the effect of massage on growth parameters in premature babies.

Keywords: Massage, premature baby, growth, weight gain, care, nursing

Introduction

Massaging a newborn baby is one of the traditional practices in Asian countries for many years. In the recent years, the use of baby massage has also increased among parents and professionals, especially in the West.[1] Massage, being used as supportive, is one of the complementary treatment methods.[2] Most of the studies have emphasized the importance of using massage as a complementary treatment method.[3,4] There are evidence which support the benefit of touch and massage therapy.[1]

Massage has physiological and psychological benefits both for mother and baby. Massage plays an important role in establishing a safe and strong bond between mother and baby.[5] Tactile contact/massage provides the development of the newborn, the organization and development of systems, the strengthening of vital mechanisms, and the establishment of communication and bonds with parents.[5-7]

Massage is one of the applications that is widely used in premature and term babies and has a positive effect. Massage is one of the therapeutic nursing practices that has positive effects on the behavioral state, respiration, and stress level of an infant.[8,9] Field et al[3] stated that massage is effective in reducing pain, increasing alertness, reducing depression, strengthening immunity, and increasing growth.

In the literature, there are studies stating that massage increases the baby's head circumference and breastfeeding frequency, decreases the bilirubin level, is effective in reducing the duration of phototherapy, has a positive effect on the mother's mood, decreases the stress hormone level, increases the duration of sleep, and shortens the hospital stay.[2,7,10-15] In addition, most of the studies in the literature emphasize that massage increases weight gain.[6,15-17] However, there are also other studies reporting that massage has no effect on weight gain.[18-20] As a result of stimulation of pressure receptors

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underneath the skin with massage, vagal activity and gastric motility increase. It also causes an increase in cholecystokinin, gastrin, insulin, and insulin-like growth factor-1 levels. It is also reported that this leads to weight gain.[21,22] There are not many studies examining the effect of massage on growth parameters in premature babies in our country. This systematic review and meta-analysis were needed to address the studies examining the effect of massage on growth parameters in premature babies and to support new studies.

Purpose and Questions of the Research

In this systematic review and meta-analysis, it was aimed to examine the effect of massage on growth in premature babies. The question of the research is does massage have an effect on growth in premature babies?

Materials and Methods

In the creation of the protocol of the systematic review and meta-analysis article, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (PRISMA Statement–Checklist for Items Required for Writing a Systematic Review or Meta-Analysis Research Report) was used.[23,24] In this study, survey, selection of studies, data extraction, and quality evaluation processes were carried out by the first and second researchers together in a joint session in order to reduce the risk of any possible error.

Eligibility Criteria

Eligibility criteria for the selection of studies were established according to PICOS which is defined as P (participants): premature infants, I (intervention): massage, C (comparison): no massage group, O (conclusion): growth parameters (head circumference, length, and weight), and S (study design): randomized controlled trials.

Exclusion criteria for articles are as follows:

a) Quasi-experimental studies, meta-analysis, systematic review, case-control, cohort studies, and letters to the editor were not included in the research.
b) Studies conducted with premature babies with congenital, genetic, and metabolic diseases and term babies were not included.

Search Strategy

The study was conducted by browsing English indexes between December 2019 and March 2020. In order to determine the studies on the effect of massage on growth in premature babies, Academic Search Complete (EBSCOHOST), Medline, Web of Science, Nursing & Allied Health Database- ProQuest, Pubmed, and Science Direct databases were searched. The keywords "massage" AND "growth" AND "nursing" AND "touch" were used during the survey. Randomized controlled studies with full text available in English between 2000 and 2020 were included in the systematic review and meta-analysis. The reference lists of the studies included for the additional studies were checked.

Study Selection

As a result of the literature survey, there was access to 1779 studies. At the end of the review made according to the title and summary, it was found that 1757 studies did not meet the research criteria (systematic review, meta-analysis, report, guideline, quasi-experimental study, review, pilot research, case, off-topic, and studies conducted in languages other than English). Fifteen studies were evaluated in terms of relevance in the full text, and 6 studies were included in the study.

Quality Assessment

The methodological quality of the articles included in this systematic review and the meta-analysis was realized in a session with the first (Erçelik) and second (Doğan) researchers and an experienced expert. Joanna Briggs Institute Critical Appraisal Checklist for randomized controlled trials was used in examining the methodological quality of research.[25] There are 13 questions in this checklist and questions are answered with the options, "yes, no, uncertain, not applicable." The evaluation results for each study in this study are given in Table 1.

Data Extraction

The data extraction tool developed by the researchers was used to obtain the research data. Data on author/year/country of the systematic review and meta-analysis, sample, type of study, intervention, growth parameters (as intervention and control), and results were collected with this data extraction tool. Data extraction was done by 2 researchers. The data extraction process was performed by the first researcher independently of the second researcher and controlled by the second researcher.

Statistical Analysis

The growth results of infants' head circumference, length, and weight gain were combined by meta-analysis in this study. Four studies focused on[15,22,26,29] the results of the change in weight gain after the intervention, while other 2 analyzed[27,28] the total weight of babies compared, and analyses were performed after clustering through these conditions.

Since the variables of the study were continuous variables, the mean difference was calculated. The meta-analysis was conducted through the program's Review Manager 5.4 (Nordic Cochrane Center, Copenhagen, Denmark). Heterogeneity between studies was assessed with the Cochran Q test and Higgins I^2, while an I^2 greater than 50% was regarded as a heterogeneity indicator. All tests were calculated in 2 ways, and the $P < .05$ value was considered statistically significant.

Results

Literature Search Results

As a result of the survey, 1776 studies were reached at from the search engines examined, and 3 studies were found out of the search engine. Fifteen studies were reached after the analysis made according to the title, abstract, and full text. As a result of the examination made according to the inclusion criteria, data extraction was performed with 6 studies (Figure 1).

Characteristics of Studies and the Participants

Three of the studies included in this systematic review and meta-analysis were conducted in the United States, 1 in Iran, 1 in India, and 1 in Brazil. Six studies published in English between 2000 and 2020 were included in the study. All of the studies included in the

Table 1. Methodological quality assessment of 6 studies according to the Randomized Controlled Trial Checklist of Joanna Briggs Institute (+=yes; −=no; ?=unclear, x="NA")

Items	Dieter ve ark. (2003)	Taheri, Goudarzi, Shariat, Nariman ve Matin (2018)	Diego, Field ve Hernandez-Reif (2005)	Massaro, Hammad, Jazzo ve Aly (2009)	Kumar, Upadhyay, Dwivedi, Gothwal, Jaiswal ve Aggarwal (2013)	Mendes ve Procianoy (2008)
Item 1	+	+	+	+	+	+
Item 2	−	−	+	−	−	?
Item 3	+	+	+	+	+	+
Item 4	−	?	x	−	−	−
Item 5	−	−	−	−	−	+
Item 6	−	+	+	−	−	+
Item 7	+	+	+	+	+	+
Item 8	+	+	+	+	+	+
Item 9	+	+	+	+	+	+
Item 10	+	+	+	+	+	+
Item 11	+	+	+	+	+	+
Item 12	+	+	+	+	+	+
Item 13	+	+	+	+	+	+

systematic review and meta-analysis were randomized controlled experimental studies. One study was studied with a double-blind method,[22] 1 study with a single-blind method,[15] and the other 4 studies did not use the blinding method. It was determined that the volume of the research sample was between 32 and 93 and that a total of 308 premature babies were included in the studies. In 3 of the studies in this systematic review and meta-analysis, massage was performed for 15 minutes, 3 times a day for 5 days.[15,22,26] (Table 2)

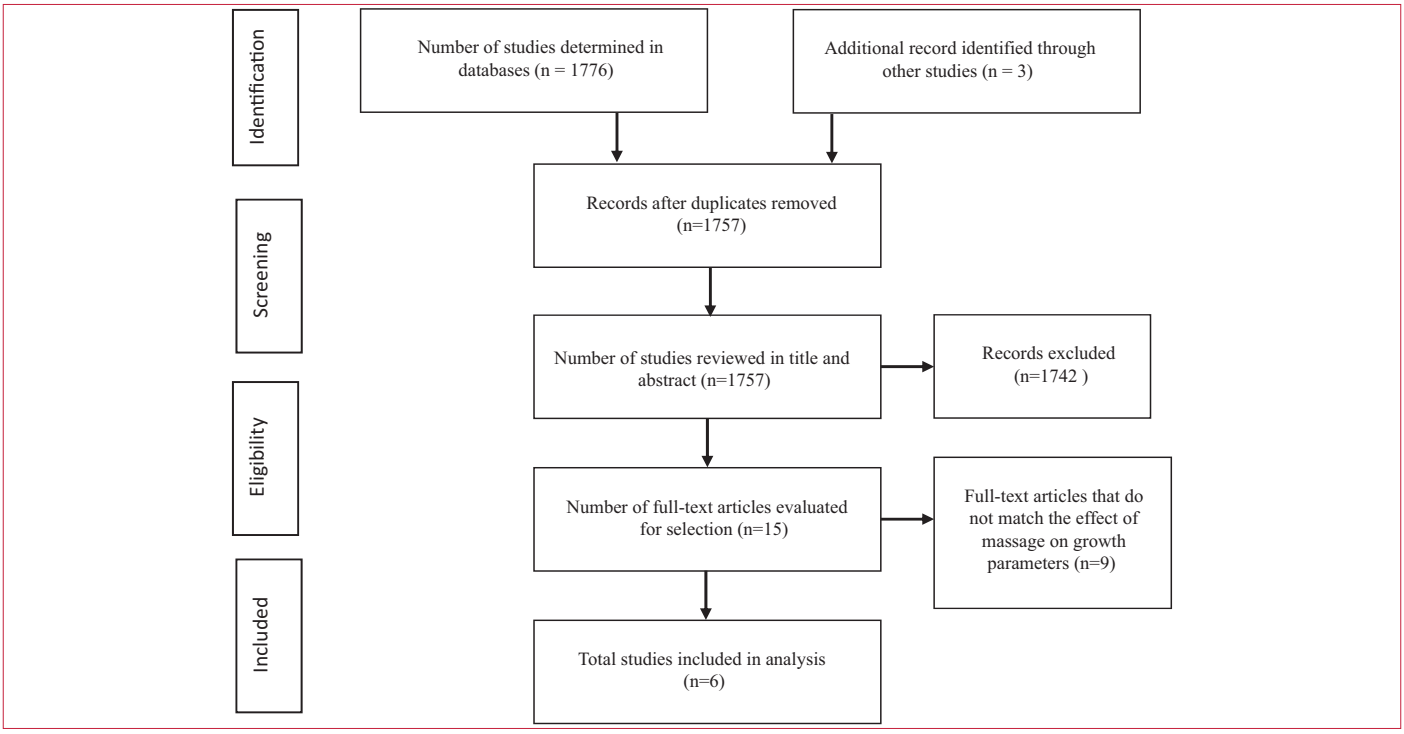


Figure 1. Selection of studies and retrieval process

Table 2. Findings Obtained in the Literature Review on the Effect of Baby Massage on Growth and Development

Author and Year/Country	Sample	Type of Study	Intervention	Growth parameters Intervention and Control	Conclusion
Dieter et al. (2003)/USA	Intervention group: 16 healthy premature babies, mean 30.1 gestation week (GW), mean birth weight 1359 g. Control group: 16 healthy premature babies, mean 31.1 GH, mean birth weight 1421 g.	Randomized controlled study	Massage was performed by massage therapists for 15 minutes, 3 times a day for 5 days.	Daily weight gain: 243.5 (184.5) and 113.5 (60.7)	It was stated that the premature babies in the massage group gained more weight.
Taheri, Goudarzi, Shariat, Nariman and Matin (2018)/Iran	30-36 corrected GW Massage group with flower oil: 22 premature babies Control group: 22 premature babies	Single-blind randomized controlled study	Massage was performed by nurses trained in massage for 15 minutes, 3 times a day for 5 days.	Daily weight gain: 14.90 ± 8.29 and −14.90 ± 37.88	It was stated that in premature babies massaged with flower oil, weight gain increased and hospitalization time decreased.
Dego, Field and Hernandez-Reif (2005)/ USA	Massage therapy group: 16 premature babies Control group: 16 premature babies	Double-blind randomized controlled study	Both the massage and placebo groups were massaged by the therapists for 15 minutes, 3 times a day for 5 days.	Daily weight gain: 19.6 ± 3.96 and 15.5 ± 3.68	It was reported that the massaged premature babies gained weight.
Massaro, Hammad, Jazzo and Aly (2009)/ USA	GH: ≤32 Control group: 20 premature babies Only massage therapy: 19 premature babies Massage therapy with kinesthetic stimulation: 20 premature babies	Prospective randomized controlled study	Massage was performed by nurses trained in massage for 15 minutes, twice a day, from recruitment to discharge.	Total weight gain: 2298 ± 82 and 2176 ± 88 Head circumference: 31 ± 0.4 and 30 ± 0.4 Length: 44 ± 0.7 and 43 ± 0.6	It was reported that premature babies who received massage therapy with kinesthetic stimulation gained more weight. It was stated that there was no effect on head circumference and length.
Kumar, Upadhyay, Dwivedi, Gothwal, Jaiswal and Aggarwal (2013)/India	<1800 g, GH: <35 Massage group with oil: 25 premature babies Control group: 23 premature babies	Randomized controlled study	Massage was performed for 10 minutes 4 times a day. During massage, equal amount of sunflower oil was used.	Total weight gain: 1.946.2 (252.1) and 1.773.2 (217.1) Length: 43.6 (2.9) and 43.9 (2.9) Head circumference: 31.9 (1.7) and 31.3 (1.5)	It was reported that low birth-weight premature babies gained more weight. It was stated that there was no effect on head circumference and length.
Mendes and Procianoy (2008)/ Brazil	≥750 vs ≤1500 g, GH: ≤32 Intervention group:46 Control group: 47	Randomized controlled study	Massage was performed by the mothers for 15 minutes 4 times a day.	Daily weight gain: 15.4 (3.8) and 14.4 (3.5) Length: 0.84 (0.27) and 0.79 (0.29)	Length, head circumference, and weight gain were similar in both groups. It was concluded that massage performed by the mother reduced the length of hospital stay and the incidence of late-onset neonatal sepsis.

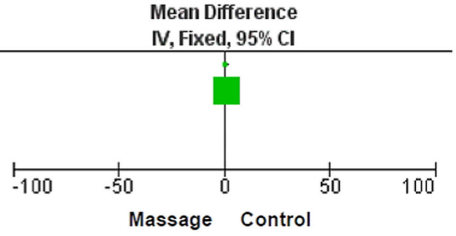
Results of Quality Assessment of Studies

Methodological quality assessment is summarized in Table 2. Randomization was performed in 6studies.[15,22,26-29] Lack of information about randomization may increase the risk of selection bias. In only 1 study, researchers blinded participants to treatment groups.[22] In 6 studies, it was observed that the participants included in the study had similar characteristics.[15,22,26-29] In 4 studies, blinding was not reported in the assignment of participants to groups.[26-29] In 3 studies, researchers who evaluated the results were assigned to the groups.[15,22,29] In all the studies, therapeutic analysis, reliable measurements, and appropriate statistical analysis were used.[15,22,26-29]

A. Head circumference

Study or Subgroup	Massage Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Kumar 2013	31.9	1.7	25	31.3	1.5	23	7.1%	0.60 [-0.31, 1.51]
Massaro 2009	31	0.4	19	30	0.4	20	92.9%	1.00 [0.75, 1.25]
Total (95% CI)			**44**			**43**	**100.0%**	**0.97 [0.73, 1.21]**

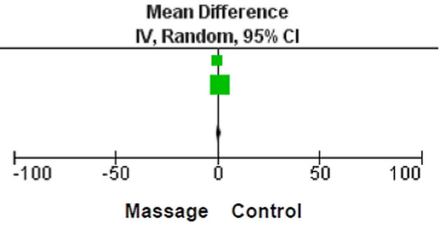
Heterogeneity: Chi² = 0.70, df = 1 (P = 0.40); I² = 0%
Test for overall effect: Z = 7.87 (P < 0.00001)



B. Length

Study or Subgroup	Massage Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Kumar 2013	43.6	2.9	25	43.9	2.9	23	30.5%	-0.30 [-1.94, 1.34]
Massaro 2009	44	0.7	19	43	0.6	20	69.5%	1.00 [0.59, 1.41]
Total (95% CI)			**44**			**43**	**100.0%**	**0.60 [-0.57, 1.78]**

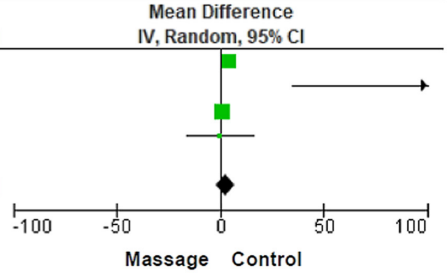
Heterogeneity: Tau² = 0.47; Chi² = 2.27, df = 1 (P = 0.13); I² = 56%
Test for overall effect: Z = 1.01 (P = 0.31)



C. Daily weight gain

Study or Subgroup	Massage Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Diego 2005	19.6	3.96	16	15.5	3.68	16	44.0%	4.10 [1.45, 6.75]
Dieter 2003	243.5	184.5	16	113.5	60.7	16	0.2%	130.00 [34.83, 225.17]
Mendes 2008	15.4	3.8	46	14.4	3.5	47	49.5%	1.00 [-0.49, 2.49]
Taheri 2018	14.9	8.29	22	14.9	37.88	22	6.3%	0.00 [-16.20, 16.20]
Total (95% CI)			**100**			**101**	**100.0%**	**2.57 [-1.78, 6.91]**

Heterogeneity: Tau² = 9.36; Chi² = 11.02, df = 3 (P = 0.01); I² = 73%
Test for overall effect: Z = 1.16 (P = 0.25)



D. Total weight gain

Study or Subgroup	Massage Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Kumar 2013	1,946.2	252.1	25	1,773.2	217.1	23	13.9%	173.00 [40.19, 305.81]
Massaro 2009	2,298	82	19	2,176	88	20	86.1%	122.00 [68.64, 175.36]
Total (95% CI)			**44**			**43**	**100.0%**	**129.09 [79.58, 178.60]**

Heterogeneity: Chi² = 0.49, df = 1 (P = 0.48); I² = 0%
Test for overall effect: Z = 5.11 (P < 0.00001)

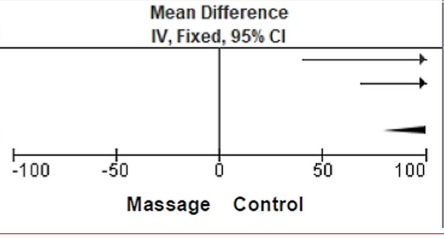


Figure 2. Meta-analysis results on growth parameters of premature babies.

Effect of Massage on Growth Parameters

Two studies reported the effect of massage on head circumference.[27,28] The combined results of these studies showed that the head circumference of the babies in the massage group was statistically significantly higher than in the control group (MD: 0.97, 95% CI: min: 0.73, Max: 1.21, $P < .001$, Figure 2).

In 2 studies, the effect of massage on length was evaluated.[27,28] The combined results of these studies did not reveal a statistically significant difference in the length of the premature babies in the massage group compared to the control group (MD: 0.60, 95% CI: min: −0.57, max: 1.78, $P > .05$, Figure 2).

In 4 studies, the effect of massage on daily weight gain was evaluated.[15,22,26,29] The combined results of these studies did not reveal a statistically significant difference in daily weight gain of premature babies in the massage group compared to the control group (MD: 2.57, 95% CI: min: −1.78, max: 6.91, $P > .05$, Figure 2).

In both studies, the effect of massage on total weight gain was evaluated.[27,28] The combined results of these studies showed that the total weight gain of the babies in the massage group was statistically significantly higher than in the control group (MD: 129.09, 95% CI: min: 79.58, max: 178.60, $P < .001$, Figure 2).

Discussion

The study revealed that the head circumference of premature babies who received massage increased, which means massage had an effect on the head circumference. Unlike the findings of our study, Underdown et al[30] in their systematic review reported that massage given to premature babies had no effect on the increase in head circumference. This difference is thought to be derived from the age difference of the babies included in the sample. In this study, it was found that massage given to premature babies had no effect on the increase in length. Similar to the findings of our study, Underdown et al[30] in their systematic review reported that baby massage had no effect on length.

In the studies reviewed, it was found that massage had no effect on daily weight gain in premature babies. Unlike our findings, in the meta-analysis conducted by Wang et al[31] and Lu et al[32], it was reported that massage had an effect on daily weight gain in premature babies. This difference is thought to be derived from the sample characteristics of the studies included in the meta-analysis and the variation of the massage practiced.

Our study shows that premature baby massage increases total weight gain. The increase in vagal activity during premature baby massage increases gastric motility and contributes to weight gain.[22,33] After examining the systematic reviews of the previous years, it was reported that premature baby massage resulted in higher weight gain.[30,34] These results reveal the necessity of providing massage training to neonatal intensive care nurses and parents.

Conclusion and Suggestions

In this study, it was concluded that massage was effective on head circumference and total weight gain in premature babies but not on the length and daily weight gain. It is suggested to integrate baby massage into the institutional culture of hospitals, provide baby massage training to neonatal intensive care nurses, organize baby massage trainings for parents, and encourage massage. In addition, there is a need for more randomized controlled studies which would examine the effects of massage on growth parameters in premature babies, such as head circumference, length, and weight gain.

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