

## Effects of therapeutic massage on premature newborn in the neonatal intensive therapy unit: a systematic review

### Efeitos da massagem terapêutica em recém-nascidos prematuros na unidade de terapia intensiva neonatal: uma revisão sistemática

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**RESUMO | INTRODUÇÃO:** A Unidade de Terapia Intensiva Neonatal (UTIN) é o local para recém-nascidos de risco que necessitam de cuidados contínuos. A massagem terapêutica é um toque sistemático das mãos humanas que contribui para o ganho de peso, diminui as respostas à dor e diminui a permanência no hospital. **OBJETIVO:** Revisar os efeitos sistêmicos da massagem terapêutica em prematuros Na Unidade de Terapia Intensiva Neonatal. **METODOLOGIA:** Esta é uma revisão sistemática. Foi realizada uma busca nas bases de dados Pubmed, Scielo e Lilacs, sem restrições relacionadas ao ano de publicação. Apenas ensaios clínicos randomizados foram incluídos neste estudo, com uma amostra de indivíduos de ambos os sexos, com menos de 28 dias de idade e abordando massoterapia relacionada a respostas sistêmicas em prematuros na unidade de terapia intensiva neonatal. Foram excluídos os estudos relacionados ao exercício físico, uso de medicamentos, estimulação oral e efeitos gastrointestinais relacionados à massagem. Foram utilizados os seguintes descritores: “massagem” AND “recém-nascido prematuro” OR “prematuro” OR “prematuro” AND “unidades de terapia intensiva neonatal”. **RESULTADOS:** Dos seis artigos incluídos nesta revisão, cinco apresentaram resultados satisfatórios sobre os efeitos sistêmicos da massagem terapêutica em recém-nascidos prematuros, como ganho de peso, diminuição da permanência na UTIN, melhora da função do sistema nervoso parassimpático e aumento da citotoxicidade celular de células assassinas naturais. Apenas um estudo relata que a massagem terapêutica não induz o sono. **CONCLUSÃO:** A massagem terapêutica produz efeitos benéficos sistêmicos em prematuros internados na Unidade de Terapia Intensiva Neonatal.

**PALAVRAS-CHAVE:** Infância. Prematuro. Massagem. Unidades de terapia intensiva neonatal.

**ABSTRACT | INTRODUCTION:** The Neonatal Intensive Care Unit (NICU) is the place for at-risk newborns who need ongoing care. Massage therapy is a systematic touch by human hands that contributes to weight gain, decreases pain responses and decreases hospital stay. **OBJECTIVE:** To review the systemic effects of massage therapy on premature infants in the Neonatal Intensive Care Unit. **METHODOLOGY:** This is a systematic review. A search was performed in the PubMed, Scielo and LILACS database, with no restrictions related to the year of publication. Only randomized clinical trials were included in this study, with a sample of individuals of both sexes, under 28 days of age and addressing massage therapy related to systemic responses in premature infants in the neonatal intensive care unit. Studies that were related to physical exercise, medication use, oral stimulation and gastrointestinal effects related to massage were excluded. The following descriptors were used: “massage” AND “premature newborn” OR “premature” OR “preterm” AND “neonatal intensive care units”. **RESULTS:** Of the six articles included in this literature review, five showed satisfactory results on the systemic effects of massage therapy on premature newborns, such as weight gain, decreased length of stay in the NICU, improvement in parasympathetic nervous system function and increased cell cytotoxicity of natural killer cells. Only one study reports that massage therapy does not induce sleep. **CONCLUSION:** Massage therapy produces systemic beneficial effects in preterm infants admitted to the Neonatal Intensive Care Unit.

**KEYWORDS:** Infant. Premature. Massage. Intensive Care units neonatal.

## Introduction

Prematurity is considered a public health problem due to the high rate of infant morbidity and mortality<sup>1</sup>. Premature babies are those born before 37 weeks of gestation, 11.8% of live births in Brazil. According to the World Health Organization - WHO, the main cause of death in children under 5 years old was premature birth<sup>2</sup>.

Due to the immaturity of organs and systems, newborns will have difficulty adapting to extrauterine life. But depending on the degree of prematurity and associated complications not all babies will need care in Neonatal Intensive Care Units (NICU)<sup>3</sup>. The NICU is the place for at-risk newborns who need ongoing care. It is an environment with a high degree of technology thus contributing to the survival of newborns<sup>4</sup>.

However, the NICU becomes a stressful environment for newborns because, in addition to the physiological consequences of prematurity, they are exposed to light, noise and medical care that lead to changes in sensory, motor and cognitive functions<sup>5</sup>.

The role of the physiotherapist in the NICU varies according to the patient, but is characterized by motor handling, pulmonary maneuvers and therapeutic positions<sup>6,7</sup>. Motor physical therapy encompasses various tactile, vestibular, proprioceptive, visual and auditory stimuli, facilitating the neuropsychomotor development of newborns<sup>6</sup>.

In this context, massage therapy is defined as a systematic touch by human hands, which generates a tactile stimulation of the premature newborn, which contributes to weight gain, decreases pain responses, improves digestion, decreases energy expenditure, decreases the length of hospital stay<sup>7</sup>.

There are several protocols regarding the type of massage, and they are often combined with other forms of stimulation, some involving moderate pressure with tactile stimuli and also associated with kinesthetic stimuli where passive flexion and extension movements of the arms and legs are performed<sup>8</sup>.

Thus, this study aims to review the systemic effects of massage therapy in premature infants in the Neonatal Intensive Care Unit (NICU).

## Material and methods

### Study search identification strategy

This is a systematic review performed by searching the MEDLINE database (PubMed), virtual health library (LILACS) and Scientific Electronic Library Online (SciELO). We selected articles in Portuguese, English and Spanish, with no restriction related to the year of publication. The search for articles was performed from February to May 2019.

The descriptors used were: "massage therapy" and "premature newborn" or "premature" or "preterm" and "neonatal intensive care units".

### Eligibility criteria

This study included only published randomized clinical trials with a sample of individuals of both sexes, under 28 days of age and addressing massage therapy related to systemic responses in preterm infants in the neonatal intensive care unit.

Studies that were related to physical exercise, medication use, oral stimulation and gastrointestinal effects related to massage were excluded.

### Methodological quality assessment

Methodological quality was evaluated according to The Cochrane Handbook for Systematic Reviews of Interventions, versão 5.1.0. Studies were evaluated according to the seven domains: types of randomization; allocation secrecy; blinding; intention-to-treat analysis; early stop for benefit; selective description of the outcome; validated scale. Risk of bias was categorized as "low risk of bias" when it was very clear in these domains, "high risk of viability" when not mentioned, and "uncertain risk of bias" if the information existed, but without clarity.

## Data extraction

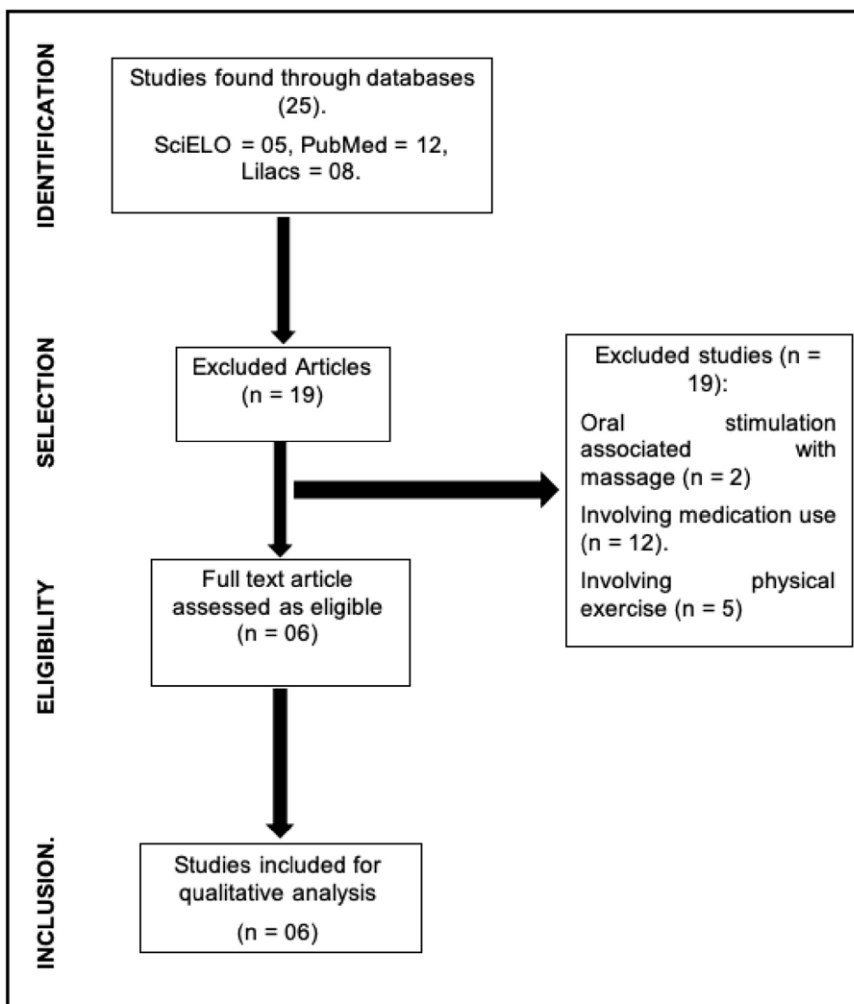
For extraction of the selected articles, we checked titles and abstracts. Subsequently, the articles were compared with the pre-established inclusion criteria in order to obtain results for the systematic review.

Two reviewers independently assessed the methodological quality of the studies, the outcome was compared and discussed until accordance was reached. If there was disagreement between the evaluators, the studies would be sent to a third evaluator.

## Results

From the search criteria, initially 25 studies were detected. After reading the selected articles, 19 were excluded due to the presence of exclusion criteria (2 because there is massage therapy associated with oral stimulation, 12 associated with medication and 5 involving physical exercise), totaling six studies for final analysis (Figure 1).

Figure 1. Flowchart for obtaining the results



The methodological quality of these six articles was analyzed using the Cochrane Collaboration tool (Chart 1). The articles were evaluated with the following criteria: high risk of bias, low risk of bias and uncertain risk of bias.

The six studies included in this systemic review discuss the systemic effects of massage therapy on preterm infants in the neonatal ICU.

**Chart 1.** Methodological quality analysis of the studies: risk of bias of each study based on the Cochrane Collaboration tool. 2019

	<b>Abdallah et al.<sup>7</sup></b>	<b>Ang et al.<sup>9</sup></b>	<b>Massaro et al.<sup>10</sup></b>	<b>Smith et al.<sup>11</sup></b>	<b>Taheri et al.<sup>12</sup></b>	<b>Yates et al.<sup>13</sup></b>
<b>Randomization Type</b>	Low risk of bias	Low risk of bias	Low risk of bias	Low risk of bias	Low risk of bias	Low risk of bias
<b>Secrecy of Allocations</b>	Uncertain risk of bias	Uncertain risk of bias	High risk of bias	Uncertain risk of bias	Uncertain risk of bias	Uncertain risk of bias
<b>Blinding</b>	Low risk of bias	High risk of bias	Low risk of bias	Low risk of bias	High risk of bias	Uncertain risk of bias
<b>Intent-to-treat analysis</b>	Low risk of bias	Low risk of bias	Low risk of bias	Low risk of bias	Low risk of bias	Low risk of bias
<b>Early stop for benefit</b>	Low risk of bias	Low risk of bias	Low risk of bias	Low risk of bias	Low risk of bias	Low risk of bias
<b>Selective Description of Outcome</b>	Uncertain risk of bias	Low risk of bias	Uncertain risk of bias	High risk of bias	High risk of bias	Low risk of bias
<b>Validated Scale</b>	Uncertain risk of bias	Uncertain risk of bias	High risk of bias	High risk of bias	Uncertain risk of bias	Uncertain risk of bias

Of the six articles included in this literature review, five showed satisfactory results on the systemic effects of massage therapy on premature newborns, such as weight gain, decreased length of stay in the NICU, improved function and development of the parasympathetic nervous system and increased cell cytotoxicity of natural killer cells. Only one study reports that massage therapy does not induce sleep immediately after massage. Chart 2 shows the main clinical trials on the subject and their results.

**Chart 2.** General data about the articles selected to obtain the results

Author	Objective	Sample	Intervention	Conclusion
<b>Massaro et al.</b> <sup>10</sup>	To evaluate the effects of massage with or without kinesthetic stimulation on premature weight gain.	GC: 20. GI1: 20. GI2: 20.	GC: Babies managed through standard care in the nursery. GC1: Child therapeutic massage with kinesthetic tactile stimulation. GI2: Massage without kinesthetic tactile stimulation.	Massage with kinesthetic tactile stimulation is associated with an improvement in daily weight gain in newborns.
<b>Abdallah et al.</b> <sup>7</sup>	To evaluate the short and long term benefits of massage in stable preterm infants.	GI: 32. GC: 34.	GI: Child therapeutic massage lasting 10 minutes. GC: Identical treatment in all NICU care areas except for massage intervention.	The results of this study indicate that massage is beneficial for stable premature babies.
<b>Yates et al.</b> <sup>13</sup>	The aim of this study was to determine if massage therapy can be used as an adjunct to induce sleep in premature babies.	MT1: 10. MT2: 13.	MT1: Received massage therapy for 10 minutes in the morning on day 1 of the study and did not receive massage on day 2 of the study. MT2: The second group did not receive massage on day 1 and did massage therapy in the morning on day 2.	Massage therapy does not induce sleep immediately after massage.
<b>Taheri et al.</b> <sup>12</sup>	To evaluate the effectiveness of the five-day sunflower oil cycle in massage with moderate pressure on weight gain and length of stay in the NICU in preterm infants.	GI: 22. GC: 22.	GI: Sunflower oil massage with moderate pressure. Each 15-minute session consists of three consecutive five-minute steps. CG: received only routine care at the NICU.	Even a short period of sunflower oil body massage increases weight gain in preterm infants and decreases length of stay in the NICU.
<b>Ang et al.</b> <sup>9</sup>	To investigate the effects of massage therapy on the immune system of preterm newborns.	GC: 62. GI: 58.	GI: Massage Therapy. Each session lasted 15 minutes and consisted of three 5-minute phases. GC: The research nurse remained behind the two large screens and spent the same amount of time without physical contact with the children.	Positive association between cytotoxicity of massage therapy and natural killer (NK) cells, as well as massage therapy and weight gain in preterm infants.
<b>Smith et al.</b> <sup>11</sup>	Test the hypothesis that massage would improve autonomic nervous system (ANS) function through heart rate variability (HRV) in preterm infants.	GI: 17. GC: 20.	GI: Modified Child Massage Protocol. It was performed for 20 minutes twice a day. GC: Control babies were supine but not given massage.	There was a positive effect of massage on parasympathetic ANS function and development.

CG - Control Group; IG - Intervention Group; TM - Therapeutic massage; HRV - heart rate variability; ANS - Autonomic Nervous System; NK - Natural *Killer* Cells; NICU - Neonatal Intensive Care Units.

## Discussion

This systematic review proposed to understand the systemic effects of massage therapy in the NICU. Although the NICU is a stressful environment due to its excessive noise, strong lighting, which generates some behavioral changes in newborns, we find that therapeutic massages are related to weight gain, reduction of hospitalization time and improved function parasympathetic ANS of newborns.

Studies point to several benefits, however, there are many variations in terms of massage technique, some with moderate pressure, others with kinesthetic tactile stimulation, characteristics of newborns, application of oils, different techniques and duration of study.

Abdallah et al.<sup>7</sup> found in the study that therapeutic massage by mothers before a heel puncture had a positive effect on post-massage pain scores in the intervention groups, also had a lower score when compared to the group control at discharge. And, according to the study by Taheri et al.<sup>12</sup>, body massage associated with kinesthetic tactile stimulation and the application of sunflower oil over a five-day course not only increased babies' weight and gain, but also decreased length of stay of these in the NICU. Shortening this period of hospitalization of newborns, besides being profitable, reduces the risk of a possible complication during the period of hospitalization.

In the study by Massaro et al.<sup>10</sup> massage therapy associated with kinesthetic tactile stimulation also generated increased weight gain in premature newborns. This result is probably related to improved basal metabolic function, since infants who have received massage or massage with kinesthetic stimulation do not consume or retain more calories than control groups, calorie intake in the studies has a similar pattern for all. That is, this metabolic efficiency generates acquisition of body mass gain.

The study by Yates et al.<sup>13</sup> aimed to determine whether massage would promote relaxation to induce sleep immediately after massage showed a significant difference in brain activity in preterm infants who received massage from electroencephalography (EEG), finding that massage stimulates brain electrical activity, thereby promoting maturation of the brain.

Although massage therapy in this study does not induce sleep immediately after massage, the benefits are associated with its application with increased cytotoxicity of natural killer cells. These cells are lymphocytes that have cytolytic activity, that is, they have the function of destroying tumor cells or virus infected cells. Still, the study by Ang et al.<sup>9</sup> showed that massage therapy has a positive association with natural killer cell cytotoxicity, and they were higher in the intervention group when compared to the control group.

The study by Smith et al.<sup>11</sup> aimed to test the hypothesis that massage would improve autonomic nervous system (ANS) function as measured by heart rate variability (HRV). However, the study by Smith et al.<sup>11</sup> shows that massage therapy developed the parasympathetic function of premature newborns in the intervention group. It is therefore clear that well-administered massage can improve the development of ANS of preterm infants who are more susceptible to stress response.

The limitations of this study are mainly regarding the presentation of variables and their parameters. In addition, the sample size of the studies varied considerably, which also contributes as a limitation.

## Conclusion

The results show that massage therapy is beneficial for premature newborns, showing positive effects on their growth, especially on weight gain. It is also associated with decreased length of NICU stay, improvement in parasympathetic ANS function and development, and increased cellular cytotoxicity, showing to be a promising technique in resource-poor settings.

## Author contributions

Cordeiro ALL participated in the research conception and design; collection, analysis and interpretation of data, writing and critical review of the manuscript. Andrade C, France F, Carvalho M participated in the conception and design of the research, data collection and writing of the manuscript. L Menezes participated in the writing and critical review of the manuscript.

## Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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