



## **Kangaroo Mother Care: scientific evidences and impact on breastfeeding**

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### **Abstract**

**Objective:** To describe the history of the Kangaroo Mother Care and present scientific evidence about benefits of this practice on morbidity and mortality, psychological and neurological development and breastfeeding of low birth weight infants.

**Sources of data:** Papers about Kangaroo Mother Care published from 1983 to 2004 were consulted, selected in Medline and Lilacs, as well as books, thesis and technical publications from the Brazilian Health Department.

**Summary of the findings:** Since its first description, Kangaroo Mother Care has been extensively studied. The analysis of randomized trials showed that it consists in a protection factor to breastfeeding at discharge (relative risk 0.41, 95% confidence interval 0.25 to 0.68). The method was always associated with the following reduced risks: nosocomial infection at 41 weeks' corrected gestational age (relative risk 0.49, 95% confidence interval 0.25 to 0.93), severe illness (relative risk 0.30, 95% confidence interval 0.14 to 0.67), lower respiratory tract disease at 6 months (relative risk 0.37, 95% confidence interval 0.15 to 0.89) and better gain of weight per day (weighted mean difference 3.6 g/day, 95% confidence interval 0.8 to 6.4). Psychomotor development at 12 months' corrected age was similar in the two groups. There was no evidence of a difference in infant's mortality.

**Conclusions:** A positive impact of Kangaroo Mother Care on breastfeeding was found. Although the method appears to reduce severe infant morbidity without any serious deleterious effect reported, there is still insufficient evidence to recommend its routine use. It is necessary to develop studies about effectiveness, acceptability and applicability of the method in the Brazilian context.

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Kangaroo mother care (KMC), also known as "kangaroo mother method" or "skin-to-skin contact", has been proposed as an alternative to conventional neonatal care for low birthweight (LBW) infants. This method was developed and first implemented by Edgar Rey Sanabria and Hector Martinez in 1979, at the Maternal and Child Institute of Bogotá, Colombia, and it received this name because it shares similarities to marsupial caregiving. It was used for the early hospital discharge of LBW infants due to a critical lack of incubators, cross infections, lack of technological resources, early weaning, high neonatal

mortality rates and infant abandonment. The new home care program for LBW infants was based on the following principles: a) early hospital discharge regardless of weight provided that the infant has stable clinical conditions; b) no use of formulas, only breastmilk; c) encouragement of early skin-to-skin contact between mother and baby; the baby is positioned on the mother's chest, and d) the baby is maintained in an upright position. This initiative was supported by UNICEF, which widely advertised the results of the study, especially with regard to the reduction in mortality rates, to psychological benefits and low cost.<sup>1</sup>

Despite the arguments over the benefits of KMC that arose from the lack of comparison of preliminary results with the results obtained from a control group, several European countries have adopted this practice and the research carried out by them has confirmed most of the initial results.<sup>2</sup> In the last few decades, several health services have adopted KMC, both in industrialized and developing countries, thus showing that it is possible to adapt this practice to different contexts of access to neonatal care technology.

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The first experiments conducted in industrialized countries demonstrated that KMC was safe in terms of physiological response of newborns and that the method brought benefits regarding the breastfeeding practice and decreased the number of hospitalizations, in addition to reducing infant crying at six months of life.<sup>3,4</sup> Two experiments carried out in developing countries showed that KMC was safe in terms of mortality, and could reduce severe morbidity and avoid hospital readmissions.<sup>5,6</sup>

In the mid-90s, a group of researchers and health professionals from several countries, with expertise in KMC, met in Trieste, Italy, to discuss the effectiveness, safety, applicability and acceptance of this type of care given to LBW newborns in different places. Based on previous studies and on the experiences reported in different health services, the group concluded that KMC can potentially improve the health and survival of LBW newborns, especially in those places where resources are scarce. However, benefits to both mothers and babies can be obtained in places where technology is available and, in this case, it contributes to the humanization of neonatal care and stronger mother-infant bonding.<sup>7</sup>

This review aims at showing the scientific evidence of the benefits of KMC regarding breastfeeding, as well as its impact on infant morbidity and mortality, and on psychoemotional and neurosensory aspects.

### **KMC in Brazil**

In Brazil, the first services to use KMC were Hospital Guilherme Álvaro, in Santos, São Paulo (1992) and the Maternal and Child Institute of Pernambuco – IMIP (1993). In 1997, the model adopted by IMIP was acknowledged by the Fundação Getúlio Vargas with the award of "Public Management and Citizenship," also receiving the *Best Practice*<sup>8</sup> award by the Brazilian Development Bank (BNDES). From then on, KMC became considerably widespread in Brazil, having become a public policy, as occurred in four other countries: Colombia, Indonesia, Mozambique and Peru.<sup>9</sup>

In 2000, the Brazilian Ministry of Health approved the Humanized Care for Low Birthweight Infants (KMC), recommending it and defining the guidelines for its implementation in medical units accredited with the Unified Health System (SUS). This policy proposes the use of KMC in three stages, starting with neonatal units (neonatal intensive care units - NICU and intermediate care units), being extended to kangaroo care units (or kangaroo rooming-in facilities) and, after hospital discharge, to outpatient clinics (domiciliary KMC). At the first stage, parents are granted early and free access to the NICU, mothers are encouraged to breastfeed and participate in baby care, and skin-to-skin contact is encouraged as soon as the baby's clinical conditions allow so. At the second stage, both mother and baby stay in a rooming-in facility, where the kangaroo position should be practiced for as long as possible. The eligibility criteria for staying in this facility are maternal availability, mother's ability to recognize situations that may put newborns at risk, and ability to place the infant in

the kangaroo position. On top of that, infants must have achieved clinical stability, total enteral nutrition, minimum weight of 1,250 g and a daily weight gain greater than 15 g. The criteria for hospital discharge and transfer to the third stage are: mother's self-assurance regarding baby care; motivation and commitment towards using the method 24 hours a day; guarantee of frequent visits to the health unit; minimum weight of 1,500 g; infant receiving exclusive breastfeeding; appropriate weight gain three days prior to hospital discharge; and agreement to seek the original hospital unit at any time while at the third stage, which usually ends when the infant reaches 2,500 g.<sup>10</sup>

Silva<sup>11</sup> assessed the policies and routines defined by the Brazilian Ministry of Health and found the following mainstays: (1) individualized care, which is parent-centered (family-centered intervention); (2) early skin-to-skin contact (appropriate and pleasant stimulation with sensory integration); (3) control of light and sound (to avoid aversive and inappropriate stimuli); (4) proper positioning (prevention of future dystonias in preterm newborns); and (5) breastfeeding (enhancing bonding and prevention of diseases in the first year of life).

We may say that the development of kangaroo mother care in Brazil was strongly influenced by the Colombian model, which served as guidelines for the program (presence of the mother, skin-to-skin contact, breastfeeding and chances of early hospital discharge) and also by other experiences with preterm baby care, such as the Newborn Individualized Development Care and Assessment Program (NIDCAP), which is based on the synactive theory of development.<sup>12</sup> According to this theory, the balance of a preterm baby's functioning is established by five subsystems (autonomic, motor, states, attention/interaction and self-regulatory) which are interconnected and interact with each other. The disorganization of a subsystem overloads the others and has a negative effect on the baby, while the organization of a subsystem has a positive effect on the other systems, allowing for equilibrium in the body.

The KMC used in Brazil can be considered to be a complex and comprehensive intervention program, which takes into consideration the global development of the baby and the environment in which he is reared. Its objective is to humanize the care LBW newborns are provided with and not to replace technology at NICUs.<sup>10</sup>

### **Scientific evidence of the role of KMC in reducing infant morbidity and mortality**

Since KMC was first described, it has been extensively studied,<sup>6,13-16</sup> although there is a paucity of methodologically appropriate studies for the analysis of its impact on morbidity and mortality.

A systematic review conducted by Cochrane Library, updated in February 2003, found only three studies comparing KMC with conventional neonatal care which met the inclusion criteria, namely the random distribution of babies weighing less than 2,500 g into the KMC or control group.<sup>17</sup> The first study, carried out in a hospital in Ecuador,<sup>5</sup> assessed the outcome of singleton babies

weighing less than 2,000 g, who had not presented with severe congenital, respiratory, metabolic or infectious disorders. A total of 140 babies were randomly assigned to the KMC group and 160 to the control group. The babies in the KMC group were submitted to skin-to-skin contact and were breastfed on demand, while control individuals were kept in incubators or in heated cribs and were breastfed at predefined schedules. The second study, conducted in Colombia,<sup>18</sup> analyzed babies weighing 2,000 g or less who did not present with early congenital malformations or perinatal disorders, whose mother or relative was available to take part in the program and had no plans to leave Bogotá in the near future. Out of 777 newborns, 396 were randomly assigned to the KMC group, being submitted to skin-to-skin contact 24 hours a day and receiving breastmilk on a regular basis, although they were formula-fed whenever necessary. The third study was carried out in three hospitals in Ethiopia, Indonesia and Mexico,<sup>19</sup> including newborns whose birthweight ranged from 1,000 to 1,999 g, without administration of oxygen and/or intravenous fluids, who were able to feed and had no malformations. Of 463 babies, 178 were excluded, and the number of newborns initially assigned to each group is not known. Babies in the KMC group were submitted to continuous skin-to-skin contact, night and day, including the time during which their mothers were asleep.

The major findings of this review, which included 1,362 babies and used standardized methods from the *Cochrane Collaboration* for statistical analysis, were the following (the relative risks and the respective confidence intervals are shown in parentheses):

- KMC was associated with reduction in nosocomial infection at 41 weeks of corrected gestational age (RR 0.49; 95%CI 0.25-0.93); reduction in the incidence of severe diseases (RR 0.30; 95%CI 0.14-0.67); and reduced incidence of lower respiratory tract infections during the six-month follow-up (RR 0.37; 95%CI 0.15-0.89).
- Babies submitted to KMC had a larger daily weight gain (mean difference of 3.6 g/day; 95%CI 0.8-6.4).
- Psychomotor development was similar in both groups at 12 months of corrected age.
- No evidence regarding differences in infant mortality was found when both groups were compared.

The authors in charge of the review conclude that, although KMC seemingly reduces infant mortality, the evidence is still insufficient to recommend the method as a routine practice, since some questions about the methodology of the assays used reduce the reliability of the findings. They also point out that more randomized, controlled and well-designed trials should be carried out. On the other hand, the same authors acknowledge that there are no reports on the deleterious effects of KMC.<sup>17</sup>

Recently, a randomized controlled trial conducted in two hospitals in South Africa revealed that babies who were submitted to skin-to-skin contact had better outcomes with regard to physiological stabilization compared to those babies who were kept in incubators.<sup>20</sup>

### **Evidence of the psychoemotional benefits related to KMC**

Separation of a baby from its family, especially from the mother, determined by the baby's clinical conditions and by the rules of conventional NICUs, may have a more negative effect than necessary on mother and child bonding, which may affect the psychoemotional development of this baby.

Some evidence exists that a close contact between the mother and the preterm baby may have a positive influence on the relationship of this baby with the world. The skin, the human body's largest organ, receives sensory stimuli of different intensity and the skin-to-skin contact, which in KMC implies the skin contact of body/chest between the preterm baby and his mother, may cause several changes in the bodies of both baby and mother. The well-known effect of the skin-to-skin contact as a stimulus to the release of oxytocin apparently plays a crucial role in the mother's behavior and seems to positively affect her mood, thus facilitating her contact with the baby.<sup>21</sup> In 1989, Affonso et al.,<sup>22</sup> in a study involving 33 mothers who had skin-to-skin contact with their preterm babies and a control group, observed a greater tendency towards emotional stability in mothers submitted to this method. They also reported a more intense feeling of reliability and competence in these mothers compared with those mothers whose babies received conventional care. Signs of establishment of an early mother and child bonding and greater involvement of parents in baby care and in the growth and development of their children was reported by Charpak et al.<sup>23</sup> and Reichert et al.<sup>24</sup> in other studies.

In a study involving 488 mothers of preterm babies, Tessier et al.<sup>25</sup> observed that those submitted to KMC felt more competent and had an increased perception of the baby's competences. Moreover, they felt less stressed even when hospital stay was longer. Advantages such as better relationship with the baby, with the health care team, better acceptance of the care received by the baby at the ICU and greater self-assurance in baby care were also reported by the parents who participated in the Kangaroo Mother Care Program by Rapisardi et al.<sup>26</sup> These subjective feelings may be seen as positive indirect signs of the establishment of a parent and child bonding favored by KMC and could be positive signs of greater participation of parents in baby care and stimulation, allowing them a more comprehensive and more individualized care.<sup>27</sup>

On the other hand, prolonged separation of the baby from the mother may have a negative effect on bonding. Klaus & Kennel<sup>28</sup> described prematurity and long hospital stay as risk factors for developmental delay, child maltreatment and abuse by family members, attributing the origin of these problems to the separation of the baby from the mother. A prospective Australian study involving 353 babies weighing less than 1,000 g treated at conventional neonatal units revealed, after the assessment of 167 cases, 80 infants with confirmed maltreatment, which could not be related to deficiencies, medical or perinatal causes, but which were mainly related to parental factors.<sup>29</sup>

### **Evidence of neurosensory benefits related to KMC**

Preterm babies are born in a period when the maturation process is at full throttle, especially with regard to the maturation of the brain and to the development of psychoemotional aspects. They have their physiological maturation interrupted and are deprived of an optimal intrauterine environment, which would offer them various comprehensive sensory and motor experiences facilitated by the lack of gravity. Their experiences would be defined by the mother's pace and they would be reasonably protected against excessive external stimuli. After birth, due to its immaturity, the extrauterine environment is expected to have a significant impact on their body. Brazelton,<sup>30</sup> in a careful study with babies, asserted that a preterm baby's nervous system becomes more easily organized while in a calm environment without excessive stimuli. Meyerhof<sup>31</sup> assessed preterm babies treated at a conventional neonatal unit, using the Brazelton scale, which consists in observing the behavioral response of newborns to different stimuli, and corroborated that a less stressful environment has a positive effect on the baby's maturation. Preterm babies who received conventional care, were kept in an incubator, and were allowed to rest and sleep in certain periods of the day, spent less time at the hospital, spent less time in the incubator and less time on a nasogastric tube. These babies also had a better control over behavioral states and autonomic stability, therefore showing a better physiological and behavioral stability.

By observing the physiological pattern during intrauterine life, we note that the baby's experiences occur in a cyclic rhythm of activity and are determined by the possibility to rest and sleep whenever necessary, which, according to Korones,<sup>32</sup> occurs in approximately 80% of the time. Mann et al.<sup>33</sup> regard sleep as a positive influence on the development of the brain.

On the other hand, an inappropriate extrauterine environment, characterized by constant stress, excessive handling, sleep deprivation, and excessive light and sound stimuli, results in effects that are adverse to the proper development of the nervous system<sup>34-39</sup> and are risk factors for a normal development.<sup>40,41</sup> The painful stimuli to which babies are exposed at the neonatal unit are considered to be the major factors for stress and disorganization. Recent studies have demonstrated that painful experiences in the neonatal period may lead to abnormal global development of preterm babies.<sup>42-44</sup>

Several neonatal intervention programs were devised based on studies showing that the environment and the way in which preterm babies are cared for may negatively interfere in their development. The aim of these programs is to protect the babies and offer adequate stimuli in order to minimize the effects of the intervention imposed by the infant's organic needs. Some programs were developed and adopted, using criteria such as decrease in light and sound stimuli and proper positioning in the incubator in order to provide self-adaptation and self-consolation, in addition to measures for pain management and the

possibility of rest and sleep periods. The results of these studies confirm that babies treated as described above had better results as to their global development even if assessed partially.<sup>45-48</sup> Appropriate positioning alone may allow for self-adaptation and proper maintenance of tone and self-consolation.<sup>49-51</sup>

Salles<sup>52</sup> evaluated 25 preterm babies treated at a neonatal unit that used protective measures for the normal development of the central nervous system (appropriate positioning in the incubator, attenuation of excessive light and sound stimuli and establishment of skin-to-skin contact including KMC) comparing them with a control group treated at a conventional care unit. The Dubowitz scale was used in babies with 40 weeks of corrected age. The group that received the protective care showed significantly better results than the control group.

The combination of these protective measures with the presence of parents at the neonatal unit, their participation in baby care and skin-to-skin contact brought new perspectives to the positive stimulation of babies.<sup>11,12,53-56</sup> The presence of parents facilitates skin-to-skin contact, which, in its turn, allows tactile proprioceptive stimulation and protects against an overload of aversive stimuli, being an acceptable method for the proper stimulation of the baby's neurobehavioral development.<sup>55</sup>

Preterm babies submitted to skin-to-skin contact showed a better mental development and better results in motor tests,<sup>56</sup> a significantly lower difference in the duration of crying and in the consolability pattern<sup>57</sup> and longer sleep periods.<sup>58</sup> Another impact on the development of a preterm baby is concerned with the presence of transient neurological disorders mainly observed in the muscle tone within the first year of life. The literature shows rates between 36 and 83%, depending on birthweight and gestational age.<sup>59-61</sup> However, Silva<sup>11</sup> observed an incidence of only 27.1% of transient tone disorders in one of the few Brazilian studies with a neurological follow-up of preterm babies in the kangaroo care program. In this study, the author assessed the neurological development of 70 preterm infants submitted to KMC, using protective measures at the neonatal unit, skin-to-skin contact and parental participation.

### **Evidence of benefits related to the breastfeeding practice**

An important mainstay of kangaroo mother care is breastfeeding encouragement. Although evidence shows countless benefits of breastfeeding for preterm babies,<sup>62-67</sup> the prevalence of breastfeeding in this group is still quite low. Xavier et al.,<sup>68</sup> in a descriptive study on breastfeeding in babies weighing 2,500 g or less born at the *Hospital das Clínicas de Ribeirão Preto*, state of São Paulo, Brazil, found that 13.5% had never been breastfed and that only 38.5% were being breastfed at 6 months of life. Lefebvre<sup>69</sup> observed that among Canadian babies weighing less than 2,500 g only 58% had been breastfed at birth, compared

to 73% in the full-term group. Among LBW infants, only 3% were discharged on exclusive breastfeeding and 11% were never breastfed.

Hellbauer et al.,<sup>70</sup> in South Africa, studied the factors that influence a mother's choice regarding the form of feeding her baby after discharge from an NICU and observed that, among other factors, LBW and prolonged hospital stay had a negative effect on her decision to breastfeed. Bicalho-Mancini et al.,<sup>71</sup> in a study about the risk factors of not exclusively breastfeeding LBW infants at an NICU in Belo Horizonte, state of Minas Gerais, before and after the implementation of the Baby Friendly Hospital Initiative, found that, although the rates of exclusive breastfeeding at hospital discharge increased from 36% (before implementation) to 54.7% (after implementation), these figures show the necessity of other interventions in order to encourage the breastfeeding of these babies. Boo,<sup>72</sup> in Malaysia, with the aim of determining the breastfeeding rate among babies weighing less than 1,500 g admitted to a high-risk neonatal unit, observed that, despite breastfeeding incentive programs adopted by the hospital, only 40.2% of these babies were being breastfed at the time of hospital discharge.

On the other hand, studies carried out in settings where KMC is used show that mothers who establish a skin-to-skin contact with their preterm babies have a significantly higher milk production compared to the

control group. Furthermore, these studies revealed that interruption of breastfeeding was more frequent among mothers who were not submitted to this method.<sup>22,73</sup> In a randomized controlled study conducted in Sweden with 71 preterm babies weighing less than 1,500 g, Whitelaw et al.<sup>4</sup> found that babies submitted to KMC had a two times higher prevalence of breastfeeding than the control group at six weeks of life (55 *versus* 28%). Ramanathan et al., in New Delhi, India,<sup>74</sup> found similar results in a study with 28 preterm babies, in which the frequency of breastfeeding at six weeks of life amounted to 85.7% for babies submitted to KMC *versus* 42.8% for control individuals. Charpak et al., in two studies carried out in Colombia (one in 1994 and the other one in 2001), revealed higher prevalences of breastfeeding at 1, 6 and 12 months of life in babies submitted to KMC compared with control individuals.<sup>6,53</sup> In Brazil, Lima et al.<sup>75</sup> and Silva<sup>11</sup> found similar results for breastfeeding rates. At six months of life, the prevalence rates of breastfeeding in these studies were respectively 63 and 60.3% for babies submitted to KMC.

Conde-Agudelo et al.<sup>17</sup> have recently analyzed three randomized trials and concluded that KMC was a protective factor for exclusive breastfeeding at hospital discharge (RR 0.41; 95%CI 0.25-0.68).

Table 1 briefly summarizes some studies on the breastfeeding of babies submitted to KMC.

**Table 1** - Studies that have analyzed KMC and the frequency of breastfeeding

Study/ Year	Country	Sample	Type of feeding	Infants' age/ time of evaluation	% of breastfed/ exclusive breastfed infants who used KMC	% of breastfed/ exclusive breastfed infants who did not use KMC
Whitelaw et al., <sup>4</sup> 1988	England	71 preterm infants with BW > 1,500 g	Breast- feeding	6 weeks	55	28
Charpak et al., <sup>6</sup> 1994	Colombia	1,084 infants with BW > 2,000 g	Breast- feeding	1 month 6 months 1 year	93 70 41	78 37 23
Lima et al., <sup>75</sup> 2000	Brazil	114 preterm infants, with mean GA of 33.4 weeks and mean BW of 1,476 g	Breast- feeding	Hospital discharge 1 month 3 months	88 87 63	-
Ramanathan et al., <sup>74</sup> 2001	India	28 preterm infants with BW > 1,500 g	Breast- feeding	6 weeks	85.7	42.8
Charpak et al., <sup>53</sup> 2001	Colombia	679 preterm infants, with GA from 32 to 37 weeks and mean BW of 1,685 g	Breast- feeding	1 month 3 months 6 months	98 81.7 51.6	-
Silva et al., <sup>11</sup> 2003	Brazil	75 preterm infants, with mean GA of 32.5 weeks and mean BW of 1,565 g	Breast- feeding	Hospital discharge (EB) 1 month 3 months 6 months	85.7 87 78 60.3	-

KMC: Kangaroo mother care; BW: birthweight; GA: gestational age.

### Final remarks

KMC in Brazil takes into account the baby's continuous growth process and introduces some possibilities to understand neonatal care in a broader context, allowing the retrieval of physiological, psychological and neurological information about human beings, considering the individual as a whole. KMC provides data on neurological, psychological and emotional development, therefore contributing to a care that suits the needs of the baby and of his family.

This review provides evidence of the benefits of KMC, which were certainly considered when this strategy was defined as a public policy in Brazil. However, it is essential that the efficiency of KMC in LBW infants in Brazil be further investigated. We should not forget that KMC was proposed here to humanize the care given to LBW infants, similarly to what occurs in industrialized countries, and not to replace the existing technology at neonatal units. The different contexts in which the method has been used should also be considered by the studies, since Brazil is characterized by large macroregional and microregional differences.

Recent Brazilian studies on the topic show the interest of researchers in subjective aspects such as the perception of parents of preterm babies about the KMC experience<sup>76</sup> and the influence of support networks on this practice.<sup>77</sup> These studies on the acceptability and applicability of KMC are crucial to provide valuable information and show us how to organize KMC in our setting.

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