

HOLD ME CLOSE: ENCOURAGING ESSENTIAL MOTHER/BABY PHYSICAL CONTACT

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It has been suggested that increased physical contact between a mother and her newborn (holding) promotes greater maternal responsiveness and more secure attachment between infant and mother, among other benefits. Current research has focused on three general types of physical contact, skin-to-skin contact (kangaroo care), in-arms holding and the use of a soft carrier to hold baby. Information from designated randomized controlled trials (RCT) will be detailed in Table 5.

Benefits of Kangaroo Care (KC)

The method of skin-to-skin contact between mother and baby (kangaroo care) is the normal mammalian post-natal condition (Ferber et al., 2004). Current research on kangaroo care has primarily focused on questions about the safety and effectiveness of this method.

Preterm infants

The benefits of skin-to-skin contact for *preterm* infants, those infants born at an estimated gestational age of less than 37 weeks, have been the most extensively studied. Historically, one of the initial motivations for promoting skin-to-skin contact between mother and premature baby was largely financial. Kangaroo Mother Intervention (KMI) started in 1978 in Colombia as a way of dealing with overcrowding and minimal resources in hospitals caring for premature babies. KMI is described as an alternative comprehensive care method to standard hospital care for Low birth weight (LBW) infants (Whitelaw, 1985). KMI has three components: 1) kangaroo position (baby is placed naked and prone upright against mother's chest), 2) kangaroo nutrition (exclusive or near exclusive breast milk), and, 3) kangaroo discharge (early dis-charge from the hospital).

In a RCT of KMI (Charpak et al., 2001), 746 infants who were born at <2000g were followed.

Infants were randomly assigned to two groups. The first group was the KMI group. These infants were kept in an upright position in skin-to-skin contact, firmly attached to the mother's chest for 24 hours a day. Their temperature thus was maintained within the normal range by the mother's body heat. The infants were breastfed regularly and premature formula supplements were used to guarantee adequate weight gain as necessary. They were examined daily until they gained at least 20g per day. They remained in the kangaroo position until they no longer accepted it. The control inter-vention infants were kept in incubators until they could regulate their temperature and show appropriate weight gain. They were usually discharged when they weighed 1700g. The practice of the neonatal intensive unit was to severely restrict the parent's access to their infants. Infants who received KMI spent less time in the hospital, the severity of infections was less, and more of these infants were breastfed until three months of corrected age.

The term "Kangaroo Mother Care" (KMC) refers to the method of skin-to-skin contact between mother and baby done directly from birth. In this method, babies are fed breast milk exclusively (usually, no premature formula supplements are given) and support is given to the mother-infant dyad. Data from RCTs have found that KMC resulted in better physiological outcomes and stability than the same care provided in incubators (Bergman et al., 2004); that KMC managed babies had better weight gain, earlier hospital discharge and, higher exclusive breast-feeding rates (Ramanathan et al., 2001); and that KMC positively impacted a mother's sense of competence and facilitated the mother-infant attachment process (Tessier et al., 1998). A recent meta-analysis (Conde-Agudelo et al., 2003) of three studies involving 1362 low birthweight infants found that KMC was associated with the

following reduced risks: nosocomial infection, severe illness, lower respiratory tract disease at 6 month follow-up, and not exclusively breastfeeding at discharge. KMC infants had gained more weight per day by discharge. Concerns about the methodological quality of the included trials led the authors to conclude that although KMC appeared to reduce severe infant morbidity without any serious deleterious effect reported, there was still insufficient evidence to recommend its routine use in LBW infants.

The term “kangaroo care” (KC) simply refers to any amount of skin-to-skin contact and is used interchangeably with the term “skin-to-skin contact.” The additional elements described in the previous methods (e.g. exclusive breast milk, early discharge) are not necessarily required. Kangaroo care improved state regulation in three RCTs. In the first trial, infants receiving KC had higher mean tympanic temperatures more quiet sleep and less crying than their counterparts (Chwo et al., 2002). A higher mean tympanic temperature (within the normal range) is a general indicator of improved neonate stability and shows their ability to maintain an appropriate body temperature. In the second trial, which was designed to study the safety of three continuous hours of KC for preterm infants (Ludington-Hoe et al., 2004), apnea, bradycardia, and periodic breathing were absent during KC. Regular breathing increased for infants receiving KC compared to infants receiving standard NICU care. In the third trial of 28 preterm infants (Ludington-Hoe et al., 2006), arousals and rapid eye movement, two developmental milestones, were significantly lower for the group that experienced skin-to-skin contact. The patterns demonstrated by the skin-to-skin group were found to be analogous to more mature sleep organization.

KC has been found to help women breastfeed successfully, which is especially important for vulnerable premature babies as breastfeeding confers immunological and nutritional benefits to babies which cannot be duplicated with premature formulas. In a RCT of 50 infants (Bier et al., 1996), mothers in the skin-to-skin group were found to have more stable milk production and were more likely to still be breastfeeding at 1 month after discharge. In a prospective observational study of 119 mothers of very low

birth weight infants, kangaroo care was one of the significant correlates that predicted successful lactation beyond 40 weeks corrected age (Furman et al., 2002).

Weaker evidence of the benefits of KC for preterm babies includes a review that found that heart rate and abdominal skin temperature rose with skin-to-skin contact and periodic breathing episodes dropped during KC (Ludington-Hoe et al., 1994). Similarly, a study of 73 KC infants who were compared with 73 matched controls, found that at term, KC infants showed more mature state distribution and more organized sleep-wake cyclicality. At 3 months, KC infants had higher thresholds to negative emotionality and more efficient arousal modulation (Feldman et al., 2002b). Another study followed 70 preterm infants, half of whom received kangaroo care, and found that KC accelerated autonomic and neurobehavioral maturation (Feldman et al., 2003). One group of researchers (Feldman et al., 2002a) found that at three months, mothers and fathers of KC infants were more sensitive and provided a better home environment. At six months, KC mothers were more sensitive and infants had higher mental and psychomotor development.

Term Infants

Only a few studies have reported the use of KC with *term* infants. One RCT (Ferber et al., 2004), which looked specifically at kangaroo care for term infants, included 47 healthy mother-infant pairs. Mothers were randomly assigned to KC shortly after delivery or the no-treatment standard care. KC began at 15 to 20 minutes after delivery and lasted for 1 hour. During a 1 hour long observation, starting at 4 hours postnatally, multivariate ANOVA revealed a significant difference between the profiles of the 2 groups ($F[10,36] = 2.39; p=0.02$): the KC infants slept longer; were mostly in a quiet sleep state; exhibited more flexor movements and postures; and showed less extensor movements. Authors concluded that KC improved state organization and motor system modulation of the term newborn infant shortly after delivery. Further evidence from RCTs found that KC had positive effects for extrauterine temperature adaptation in hypothermic term infants (Huang et al., 2006); and that KC had an analgesic effect for term

infants during a standard heel lance procedure (in the skin-to-skin group, crying and grimacing were reduced by 82% and 65% respectively) (Gray et al., 2000).

A recent meta-analysis of KC (Anderson et al., 2003) found that KC after birth had a positive effect on long-term breastfeeding in term dyads, and that the temperature of the healthy, newly delivered infant remained in a safe range, provided ventral-to-ventral KC was uninterrupted and the infant was thoroughly dried and covered across the back. In another study, KC was found to significantly decrease crying 60 minutes post birth in term infants (Christensson et al., 1995). Studies have shown that maternal touch by massage rather than by holding in the postnatal period also was beneficial in terms of improved weight gain in preterm infants (Ferber et al., 2002a) and in maturation of circadian rhythms and melatonin secretion in term infants (Ferber et al., 2002b). In a case study of 3 mothers with full term infants with breastfeeding difficulties, infants were held in kangaroo care for one hour prior to breastfeeding. KC was found to be a worthwhile intervention to try when mother and full term infant are struggling to achieve breastfeeding success (Meyer et al., 1999).

Benefits of In-Arms Holding

Simple holding, even without the skin-to-skin contact, also has benefits including reduced crying and more secure attachment. In one RCT (Hunziker et al., 1986), 99 mother-infant pairs were randomly assigned to either the supplemental carrying group in which parents were asked to carry their baby for a minimum of three hours per day and infant carriers were provided, or to the traditional care group. At the time of peak crying (6 weeks old), infants who received supplemental carrying cried and fussed 43% less overall and 51% less in the evening hours (4 pm to midnight).

In an effort to treat excessive crying in newborns, one RCT (Barr et al., 1991) focused on KC as a therapy for colic. 66 mothers of infants 4 weeks of age or less who came to their pediatricians with complaints of crying problems were randomized to either standard pediatric advice plus the recommendation to increase

supplemental carrying by 50% or standard pediatric advice alone. The supplemental group carried their infants 6.1 hours/day throughout the intervention period, an increase of 2.2 hours/day (56%) more than that provided by the standard group. There was no difference between groups in the duration or frequency of crying or fussing at any time throughout the intervention period. KC was not found to be an effective therapy for colic and the authors speculated that in marked contrast to healthy infants, this apparent resistance to increased carrying may indicate an important difference in state regulation and control in infants with colic.

Soft Baby Carriers Facilitate Holding

With the understanding that having access to a soft baby carrier can facilitate holding, one RCT specifically provided soft carriers to new moms to study the effect. In this trial (Anisfeld, 1990), 49 mothers of newborn infants were randomly assigned to either receive a soft baby carrier or a plastic infant seat. Subjects were asked to use their product daily. Using a transitional probability analysis of a play session at 3 ½ months, mothers in soft baby carrier group were more contingently responsive to their infants' vocalizations. When the infants were 13 months old, the Ainsworth Strange Situation was administered and more experimental than control infants were securely attached to their mothers. Authors concluded that mothers who were given soft carriers at birth were more responsive to their babies and the babies were more securely attached.

The safety of soft carriers was studied in a 3-period crossover trial in which 24 preterm and 12 term newborns were continually monitored while being carried horizontally or vertically in a sling or lying in a pram (Waltraud et al., 2002). The 90% confidence interval of oxygen saturation in both infant sling positions remained within a +/- 2% interval around the average oxygen saturation in the pram. Authors concluded that preterm and term infants who were carried in slings were not at risk of clinically relevant changes of oxygen saturation or heart rate.

Table 5: Effectiveness of mother/baby physical contact (RCT)

Study	Participants	Intervention	Outcome
Chwo et al., 2002	34 premature newborns	Group 1: KC Group 2: Standard premature baby care	Mean tympanic temperature: Group 1: 37.3 degrees C*, Group 2: 37 degrees C (p<0.001). More quiet sleep: 1: 62%*, 2: 22% (p<0.001) Crying: 1: 2%*, 2: 6% (p<.0.01)
Charpak et al., 2001	746 premature newborns (<2000g)	Group 1: KMI – Skin-to-skin contact on the mother’s chest 24 hours/day, nearly exclusive breastfeeding, and early discharge, with close ambulatory monitoring. Group 2: Traditional care – Infants remained in incubators until the usual discharge criteria were met.	Days spent in the hospital at term: (among infants <1200 g) Group 1: 5.8 days*, Group 2: 15.9 days Frequency of nosocomial infections: 1: 3.4%*, 2: 6.8% (rate ratio 2.01, 95% CI: 1.04-3.87) Breastfed at 3 months corrected age: 1: 81.7%*, 2: 75.3% (p=.05)
Bergman et al., 2004	34 premature newborns between 1200 and 2199g at birth	Group 1: KMC Group 2: Incubator care	Stabilization score (measured in terms of a set of pre-determined physiological parameters, and a composite cardio-respiratory stabilization score): Group 1: 77.11,* Group 2: 74.24, mean difference 2.88 (95% CI: 0.3-5.46, p=0.031) Stable in the sixth hour: 1: 18/18,* 2: 6/13
Ramanathan et al., 2001	28 premature newborns whose birth weight was less than 1500g	Group 1: KMC for at least four hours per day in not more than 3 sittings. KMC after shifting out of the NICU and at home Group 2: Standard care (incubator or open care system)	Weight gain after first week of life: Group 1: 15.9+/- 4.5g/d*, Group 2: 10.6+/-4.5g/d (p<0.05). Days in hospital: 1: 27.2*, 2: 34.6 (p<0.05). Exclusively breastfeeding at 6 weeks: 1: 12/14*, 2: 6/14 (p<.0.05).
Tessier et al., 1998	488 premature newborns weighing <2001g and their mothers	Group 1: KMC- Breast-milk and preterm formula. Infants monitored daily until gaining 20g/day. Group 2: Standard NICU care. Incubators until appropriate weight gain. Discharged after weight is 1700g.	“Bonding effect”- change in mother’s perception of her child as being within normal limits was observed in Group 1 mothers. “Resilience effect”- In stressful situations Group 1 mothers felt more competent than Group 2 mothers.

Study	Participants	Intervention	Outcome
Ludington-Hoe et al., 2004	24 premature newborns (33-35 weeks gestation at birth) nearing discharge	Group 1: KC for 3 continuous hours Group 2: Standard NICU care	Group 1: Mean cardiorespiratory and temperature outcomes remained within clinically acceptable ranges. Group 1: Apnea, bradycardia, and periodic breathing were absent. Regular breathing increased.
Ludington-Hoe et al., 2006	28 premature newborns	Group 1: KC Group 2: Routine NICU care	Arousals and rapid eye movement were significantly lower for Group 1.
Huang et al., 2006	78 consecutive cesarean term newborns with hypothermia problems	Group 1: KC with their mothers in the post-operative room Group 2: Routine care under radiant warmers	Mean temperature: Group 1: 36.29 degrees C*, Group 2: 36.22 degrees C (p=0.044)
Bier et al., 1996	50 premature newborns with birthweights <1500g whose mothers planned to breast feed	Group 1: KC - infants were clothed in a diaper and held upright between mothers' breasts; both mother and infant were covered with a blanket Group 2: Standard contact- infants were clothed, wrapped in blankets, and held cradled in mother's arms.	Oxygen saturation readings of less than 90% during intervention: Group 1: 11%*, Group 2: 24% (p<0.001). More stable milk production in Group 1. Continued breastfeeding at 1 month after discharge: 1: 50%*, 2: 11% (p<0.01).
Ferber et al., 2004	47 term newborns and their mothers	Group 1: KC beginning at 15 to 20 minutes after delivery and lasting for 1 hour. Group 2: Standard care	During a 1 hour observation, starting 4 hours postnatally, Group 1 infants slept longer, were mostly in a quiet sleep state, exhibited more flexor movements and postures and showed less extensor movements. Multivariate ANOVA F[10,36] = 2.39* p=0.02
Gray et al., 2000	30 term newborns	During a standard heel lance procedure: Group 1: Held by their mothers in a whole body, skin-to-skin contact Group 2: Swaddled in crib	In Group 1: Crying was reduced by 82%* Grimacing was reduced by 65%* (p<0.0001 for both)
Hunziker et al., 1986	99 term newborns	Group 1: Parents were asked to carry their baby for a minimum of three hours per day, and it was emphasized that carrying should occur throughout the day, not only in response to crying.	Group 1 at 6 weeks of age cried and fussed 43% less overall (1.23 v 2.16 hours/day) and 51% less during evening hours (4 pm to midnight) (0.63 v 1.28 hours). (p<0.001)

Study	Participants	Intervention	Outcome
		Group 2: Traditional care	
Barr et al., 1991	66 mothers of infants 4 weeks of age or less who came to their pediatricians with complaints of crying problems	Group 1: Standard pediatric advice plus the recommendation to increase supplemental carrying by 50% Group 2: Standard pediatric advice	No difference between groups in the duration or frequency of crying or fussing at any time throughout the intervention.
Anisfeld et al., 1990	49 mothers of term newborns	Group 1: Received soft baby carriers Group 2: Received plastic infant seats	Mothers mean responsivity score at 3 ½ months: Group 1: .56*, Group 2: .33 (p<0.02) Infants securely attached to mother at 13 months old (Ainsworth Strange Situation): 1: 83%*, 2: 38% (p=.019).

Conclusions

In sum, safety has been adequately demonstrated for all types of holding (kangaroo care, in-arms and in a sling). There is strong evidence to support the use of kangaroo care for *preterm* babies with benefits that include shortened hospital stay, decreased morbidity, higher exclusive breastfeeding rates/longer breastfeeding duration, increased weight gain, improved state regulation, and improved maternal sense of competence. Evidence-based benefits of KC for *term* babies include improved state organization and motor system modulation; improved extrauterine temperature adaptation; and an analgesic effect. No serious deleterious effects were reported. Simple holding, without the skin-to-skin contact, was found to reduce crying, and the provisions of soft carriers led to mothers who were more responsive to their babies and to babies who were more securely attached. Given the many benefits of physical contact between mother and baby, it appears reasonable to encourage this essential practice of holding – promoting skin-to-skin contact, in-arms holding, and holding in a soft baby carrier, as a matter of course in the care of new babies (both premature and term) and their parents.

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