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RESEARCH

# Positive Effect of Kangaroo Mother Care on Long-Term Breastfeeding in Very Preterm Infants

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## ABSTRACT

**Objective:** To investigate the use of Kangaroo Mother Care (KMC) and its association with breastfeeding at 1 to 6 months of corrected age in mothers of very preterm (VPT) and preterm (PT) infants.

**Design:** Prospective longitudinal study.

**Setting:** Neonatal Intensive Care Units in four counties in Sweden.

**Participants:** The study included 103 VPT (<32 gestational weeks) and 197 PT (32-36 gestational weeks) singleton infants and their mothers.

**Methods:** Data on KMC, measured in duration of skin-to-skin contact/day during all days admitted to a neonatal unit, were collected using self-reports from the parents. Data on breastfeeding were obtained by telephone interviews.

**Results:** VPT dyads that breastfed at 1, 2, 5, and 6 months had spent more time in KMC per day than those not breastfeeding at these times. A trend toward significance was noted at 3 and 4 months. In the PT dyads no statistically significant differences were found in the amount of KMC per day between those dyads that breastfed and those that did not.

**Conclusions:** This study shows the importance of KMC during hospital stay for breastfeeding duration in VPT dyads. Hence, KMC has empowering effects on the process of breastfeeding, especially in those dyads with the smallest and most vulnerable infants.

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Because breast milk mediates unequalled beneficial effects regarding nutritional, immunological, and cognitive outcomes in infants, a global public health recommendation is that infants should be exclusively breastfed for the first 6 months of life (Kramer & Kakuma, 2002). This recommendation extends to preterm infants (Gartner et al., 2005; World Health Organization, 2003) because they are often at increased risk for infections and long-term ill health and because the positive effects of breast milk are even more prominent in these infants (Anderson, Johnstone, & Remley, 1999; Schanler, Shulman, & Lau, 1999). Very preterm infants (VPT, <32 gestational weeks [gw]) constitute an even more vulnerable population with respect to morbidity and risk for behavioral problems (Delobel-Ayoub et al., 2006; Hack & Fanaroff, 1999). In addition, because VPT infants require neonatal care for a substantial period (Ringborg, Berg, Norman, Westgren, & Jonsson, 2006) and because their sucking behavior is immature (Nyqvist, Sjoden, & Ewald, 1999), the VPT dyads are a clinically more challenging population on the initiation and sustainability in breastfeeding than preterm infants (PT, 32-36 gw). Few reports have been published on the breastfeeding duration in PT and VPT infants. A study undertaken in Finland and Germany (Wolke, Sohne, Riegel, Ohrt, & Osterlund, 1998) showed that 40% of the Finnish PT infants and 10% of the German PT infants were breastfed at 5 months of corrected age. For the VPT infants, less than 10% were breastfed in both countries. In Sweden, reports have documented that 62% of PT infants and 45% of VPT infants were breastfed at 6 months postnatal age (Flacking, 2007; Flacking, Wallin, & Ewald, 2007), indicating that Sweden is a very probreastfeeding culture. In two studies reporting on the rate of exclusive breastfeeding, it was found that 3% to 17% of the PT infants and 0% to 5% of the VPT infants were breastfed exclusively at 5 or 6 months of corrected age (Akerstrom, Asplund, & Norman, 2007; Wolke et al.).

The question on how to optimize the transitional process from gavage feeding alone to breastfeeding alone has only been superficially addressed. The transitional process has been regulated by a diversity of non-evidence-based guidelines and care routines. However, Kangaroo Mother Care (KMC), which has an extensive research base, is regarded as a successful way to empower mothers to become familiar with their infants, strengthen their mothering at their own pace, and increase breastfeeding duration (Conde-Agudelo, Diaz-Rossello, & Belizan, 2003; Feldman, Eidelman, Sirota, & Weller, 2002; Hake-Brooks & Anderson, 2008). KMC is based on skin-to-skin contact between the mother and her newborn preterm or low-birth-weight infant (Cattaneo, Davanzo, Uxa, & Tamburlini, 1998). The term *KMC* is used to represent skin-to-skin care in Kangaroo position practiced as continuous and intermittent skin-to-skin contact (Nyqvist et al., 2010).

In a qualitative study of Swedish mothers' experience of breastfeeding and becoming a mother to a VPT (Flacking, Ewald, Nyqvist, & Starrin, 2006) early initiation of KMC and breastfeeding was regarded as "conformational" and as a healing state that helped strengthen the mother-infant relationship. Breastfeeding became regarded as "reciprocal" in that it was experienced as mutually pleasurable, without any demands of "succeeding" and as a fulfillment of the emotional needs of the infant and mother. Several studies have investigated the influence of KMC on breastfeeding duration. A few studies from low- and middle-income countries have shown that more preterm infants who experience KMC are breastfed at discharge compared to those who receive conventional care (Boo & Jamli, 2007; Cattaneo et al., 1998; Charpak, Ruiz-Pelaez, Figueroa de, & Charpak, 2001). KMC has also shown to be beneficial for a longer breastfeeding duration and breastfeeding exclusivity in affluent societies (Hake-Brooks & Anderson, 2008). However, other studies have found that there are no differences between infants that received KMC and infants that received conventional care on breastfeeding duration (Charpak et al.; Roberts, Paynter, & McEwan, 2000). The discrepancy in outcomes is likely attributable to differences in study design and setting.

The aim of this study was therefore to investigate the use of KMC in Neonatal Intensive Care Units (NICUs) and its association with breastfeeding at 1 to 6 months of corrected age in mothers of VPT and PT infants in a setting highly conducive to breastfeeding.

# Method

## Design and Sample

This prospective, longitudinal study was performed at four NICUs located at hospitals in four counties in Sweden. The study was originally conducted as an intervention study evaluating facilitation support in the implementation of KMC guidelines. Study details are described elsewhere (Wallin, Rudberg, & Gunningberg, 2005). In this article we focus on the potential link between KMC and breastfeeding.

The study was conducted at four NICUs during a study period of 19 months (April 2001 to November 2002). All infants born $<37$ gw, hospital cared for at least 72 hours, and residents in the catchment area were eligible in the first step of population sampling ($N = 811$). Infants were excluded if the mother was not Swedish speaking ($n = 47$), had severe medical or psychological problems preventing inclusion ($n = 30$), or if the infant was referred to another hospital unit ($n = 75$), or had a severe congenital malformation or died during hospital stay ($n = 26$). In addition, of the 663 eligible infants, 51 mothers of these infants were overlooked by the recruitment procedure whereas 189 mothers refused to participate. For the purpose of this study, 123 twins were excluded. Thus, the final sample consisted of 300 singleton infants, of which 103 were born $<32$ gw and 197 born 32 to 36 gw. Sixteen of the 300 infants were discharged to another NICU or to a postnatal unit but were included in the study in that they were followed up in the same way as infants discharged home. Power calculations were made in relation to the original implementation study, but not to this substudy.

## Procedures

The study was approved by the Research Ethics Committee of the Medical Faculty at Uppsala University. The purpose of this study was fully explained to each participant, and they gave their informed consent in writing. Data on infant characteristics, parity, maternal age, and mode of delivery were obtained from the infant's patient record by a contact nurse working at each of the NICUs. Data on the mother's educational level and smoking status were obtained from questions in a survey mailed to the mothers 2 months after discharge.

Data on KMC were gathered through self-reports by the infants' parents (primarily the mothers). The parents were given information on the study, on how the KMC was defined (infant placed skin-to-skin on mother or father, having only a diaper and a cap/socks on when necessary and covered with a blanket), and on how to fill out the reports on KMC.

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This information was given to the parents as soon as the infant was stable enough to initiate KMC. Normally, the parents were approached within the first few days after delivery. If KMC had occurred before that time, these episodes of KMC were reconstructed by the parents with the help of the contact nurse.

The self-reports, which covered a 2-week period, were in the format of calendars. In the calendar the parents marked the initiation and ending of each skin-to-skin episode rounded to the nearest 5- or 10-minute interval. At the end of the 2-week period, the nurse recontacted the mother, collected the calendar, and gave the mother a new calendar for the next 2-week period. This procedure continued for the whole period of hospital stay. Through these regular meetings, the parents were encouraged to continue to fill in the episodes of KMC. In addition, erroneous handling of the calendars could be corrected during the meetings. In the training of the contact nurses it was emphasized that in all contacts with the parents the request of information about the episodes of skin-to-skin should not be understood as a recommendation or as guidance to carry out KMC. Rather, it was a recording of "ordinary" care and nothing else. The data collection tool was developed for the study, and different versions were pilot tested on a group of mothers at one of the four NICUs. When taking size and other practicalities into account, the 2-week version was found to be the most appropriate.

In this study *breastfeeding* was defined as being breast milk fed (regardless of method) in concordance with the definitions from the World Health Organization (WHO) and the Swedish National Board of Health and Welfare (The National Board of Health and Welfare, 2007; World Health Organization, 2007). Data on breastfeeding were obtained from telephone interviews conducted by the contact nurses at 2, 4, and 6 months of corrected age. At each time point (i.e., 2, 4, and 6 months), the contact nurse asked the mother about her breastfeeding at present and previous month (at 1, 3, and 5 months). Information was obtained regarding (a) if the infant was breast milk fed, (b) the method used to give the infant breast milk (only breast, breast and bottle, only bottle or other method), and (c) the extent of breastfeeding (exclusive = breast milk, vitamins, and medication; partial = breast milk and water/juice/formula/food, or no breastfeeding).

### Statistical Analyses

Using the *t* test, we analyzed the association between maternal and infant characteristics and duration of skin-to-skin contact (KMC) per day. The association between duration of KMC per day during hospital stay (independent variable) and the dependent variables of breastfeeding (yes or no), extent of breastfeeding (exclusive or partial), and method of feeding breast milk (only breast or breast+bottle/only bottle/other method) was performed by *t* tests. Potential differences at 1 to 6 months between VPT and PT infants in breastfeeding, extent of breastfeeding, and method of feeding breast milk were analyzed with the chi-square test. For all tests, the significance level was set at $p < .05$ (two-sided). The statistical package SPSS 14.0 for Windows (SPSS Inc., Chicago, IL) was used for statistical analyses.

## Results

### Demographic Characteristics

Demographic characteristics of mothers and their VPT and PT infants are presented in Table 1. Mothers of VPT infants had a mean age of 31 years (*SD* ± 5) and mothers of PT infants of 30 years (*SD* ± 5). The gestational age at birth ranged from 24 to 31 weeks (median 29 weeks) in the VPT infants and from 32 to 36 weeks (median 34 weeks) in the PT infants. The VPT infants weighed from 508 to 2,263 g, and the PT infants from 1,365 to 4,125 g. The length of hospital stay varied from 11 to 101 days in the VPT infants and from 4 to 40 in the PT infants. The gestational age and weight at discharge from the hospital in the VPT infants ranged from 31 to 41 weeks and

**Table 1: Characteristics of Mothers and Their Very Preterm (VPT, *n* = 103) and Preterm (PT, *n* = 197) Infants**

| | VPT < 32 gw | | PT 32 to 36 gw | |
|---|---|---|---|---|
| Demographic Variables | *n* | % | *n* | % |
| Maternal educational level | | | | |
| Compulsory school or less | 4 | 4.2 | 7 | 3.9 |
| Upper secondary school | 50 | 52.1 | 77 | 43.3 |
| Higher education | 42 | 43.7 | 94 | 52.8 |
| Primiparous | 62 | 60.2 | 134 | 68.0 |
| Mother smoke | 12 | 12.5 | 14 | 7.1 |
| Caesarean | 69 | 69.0 | 94 | 48.0 |
| Male gender | 47 | 45.6 | 107 | 54.3 |
| Ventilator care | 27 | 26.2 | 3 | 1.5 |
| CPAP care | 92 | 89.3 | 63 | 32.0 |
| Extra oxygen | 57 | 55.3 | 44 | 22.3 |

*Note.* CPAP = continuous positive airway pressure.

1,060 to 3,455 g. In the PT infants the corresponding figures were 34 to 40 weeks and 1,660 to 4,150 g.

## Use of Kangaroo Mother Care

In the VPT infants 36% of the dyads had KMC during the first day of the infants' life and an additional 31% the following day. In contrast, 77% of the PT dyads initiated KMC within the first day and 14% the following day. The only maternal demographic variable associated with duration of KMC per day was parity: primiparous mothers had more time of KMC with their infants than multiparous mothers ($p < .01$). Infants in both groups who were ventilated or received continuous positive airway pressure (CPAP) or extra oxygen had more days in an incubator before they were placed KMC for the first time ($p < .05$). In addition, infants needing ventilator care had less KMC time per day than other infants ($p < .05$). The PT dyads had significantly more KMC episodes per day (mean 1.82 ± 1.43) than VPT dyads (1.43 ± 0.82) ($p < .05$). In addition, the VPT dyads experienced significantly more total minutes of KMC (mean 5,911 ± 3,781) than PT dyads (mean 1,890 ± 1,826) ($p < .001$). However, the average duration of KMC per day during the hospital stay did not differ between the groups: the average number of minutes per day was 130 (*SD* ± 78) in the VPT dyads and 127 (*SD* ± 103) in the PT dyads ($p = .696$).

## Association Between Kangaroo Mother Care and Breastfeeding Duration

Figure 1 shows the percentage of VPT and PT infants who breastfed (exclusive and partial) at 1 to 6 months of corrected age. A statistically significant difference was found between the two infant groups at each time point ($p < .05$), indicating that PT infants were more likely to be breastfed than VPT infants.

**At 6 months of corrected age, 58% of the preterm infants and 43% of the very preterm infants were breastfeeding.**

In both infant groups the amount of time spent in KMC per day was not associated with breastfeeding incidence at 1 to 6 months. The association between duration of KMC per day and breastfeeding was also analyzed separately in the VPT and PT infants (Table 2).

*t* test showed that VPT dyads that breastfeed had experienced more time in KMC per day than VPT dyads that did not breastfeed at 1 ($p = .04$), 2 ($p = .04$), 5 ($p = .01$), and 6 months ($p = .04$); however, no significant differences could be detected at 3 ($p = .08$) or 4 months ($p = .06$). In contrast, in the PT group no differences were observed between those dyads that breastfed and those that did not.

## Association Between Kangaroo Mother Care and Exclusive Breastfeeding

The percentages of exclusive and partial breastfeeding are given in Figure 2. The rate of exclusive breastfeeding among VPT infants was 51%, 45%, 34%, 15%, 4%, and 1% at 1, 2, 3, 4, 5, and 6 months of corrected age, respectively.

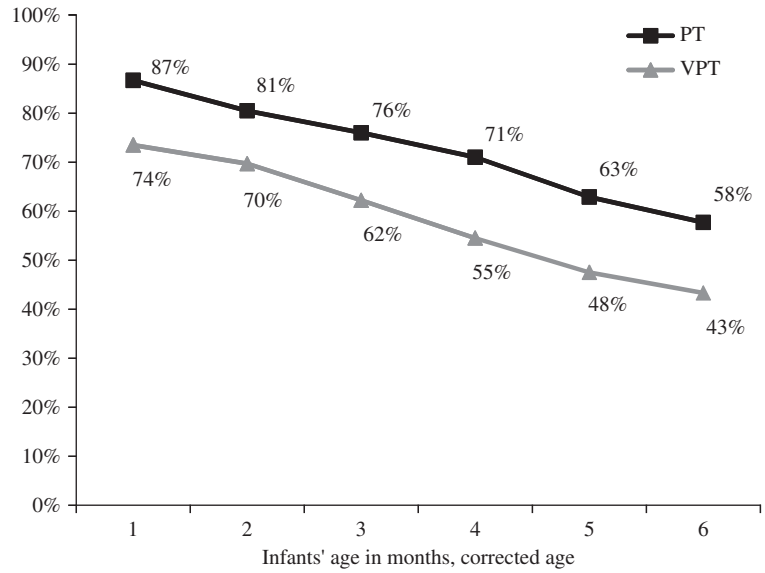


**Figure 1.** Duration of breastfeeding (exclusive/partial) in preterm (PT) (32-36 gestational weeks) and very preterm (VPT) (<32 gestational weeks) infants at 1 to 6 months of corrected age.

**Time spent skin-to-skin in the neonatal intensive care unit is associated with breastfeeding duration in very preterm infants.**

Corresponding percentages among the PT infants were 71%, 63%, 44%, 18%, 9%, and 2%. A significant difference between the VPT and PT groups at 1 and 2 months of corrected age was noted, that is, the PT infants were more likely to be breastfed exclusively.

The association between duration of KMC per day and exclusive versus partial breastfeeding at 1 to 6 months was analyzed for all infants, as well as for VPT and PT infants separately. None of these analyses revealed a significant association.

### Association Between Kangaroo Mother Care and Feeding Method

Results from the analyses on what methods were used to give breast milk to the infants from 1 to 6 months of corrected age are presented in Table 3. The majority of infants that were fed breast milk by other methods than "only breast" received breast milk through a combination of breast and bottle. There was no difference in method of feeding between VPT and PT dyads at any of the time points.

The association between duration of KMC per day and method of feeding breast milk was analyzed for all infants. The results showed that infants who were given breast milk by "breast only" at 1 month ($p < .05$) and 3 months ($p < .05$) had experienced more KMC time per day than infants who were given breast milk by "breast and bottle/only bottle/other method." No difference between PT and VPT infants was found at 2, 4, 5, and 6 months. When analyzing the PT group separately, the same associations were found as those in all infants. No associations were observed in a separate analysis of the VPT dyads.

## Discussion

This study provides data on the association between amount of time spent in KMC and breastfeeding in VPT and PT dyads. Our findings showed an association between KMC and breastfeeding at 1, 2, 5, and 6 months in VPT dyads.

Even though a statistical difference could not be detected at 3 ($p = .08$) and 4 months ($p = .06$), the overall association between KMC and breastfeeding is striking. This is the first study demonstrating that KMC, measured in time spent skin-to-skin between the parent and the infant, is associated with breastfeeding duration in VPT infants. However, the findings from this study must be interpreted with caution as it may be biased because of the self-selection of mothers. Thus, mothers who are more positive toward KMC may also be more positive toward breastfeeding. It would have been beneficial if an analysis could have been made on baseline variables such as demographics in included and nonincluded mothers, but for ethical reasons no such data were gathered for the nonincluded mothers. From an international perspective, the incidence of breastfeeding is extraordinarily high in both groups: 87% of the PT infants and 74% of the VPT infants were breastfed at 1 month of corrected age; at 6 months of corrected age, the corresponding figures were 58% and 43%. In addition, nearly 9 of 10 infants were fed breast milk at breast and not by other methods, data that seem to be disregarded in many studies (McInnes & Chambers, 2008). The high rates of breastfeeding in this study are equivalent or even higher to reports on the breastfeeding duration in term infants from the United States, Canada, Australia, and several

**Table 2: Association Between Minutes of Skin-to-Skin/Day and Breastfeeding (Exclusive and Partial) in Very Preterm (VPT, $n = 103$) and Preterm (PT, $n = 197$) Dyads**

| | 1 Month | | 2 Months | | 3 Months | | 4 Months | | 5 Months | | 6 Months | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | Mean ± *SD* | *n* | Mean ± *SD* | *n* | Mean ± *SD* | *n* | Mean ± *SD* | *n* | Mean ± *SD* | *n* | Mean ± *SD* |
| VPT bf | 72 | 139 ± 84* | 69 | 140 ± 84* | 61 | 141 ± 87 | 54 | 144 ± 85 | 47 | 151 ± 85* | 42 | 149 ± 80* |
| VPT not bf | 26 | 108 ± 59 | 30 | 109 ± 62 | 37 | 114 ± 61 | 45 | 115 ± 68 | 52 | 112 ± 68 | 55 | 116 ± 75 |
| PT bf | 169 | 126 ± 104 | 157 | 127 ± 105 | 146 | 125 ± 102 | 137 | 126 ± 101 | 122 | 126 ± 98 | 112 | 124 ± 98 |
| PT not bf | 26 | 127 ± 98 | 38 | 123 ± 95 | 46 | 133 ± 108 | 56 | 131 ± 109 | 72 | 129 ± 110 | 82 | 131 ± 110 |

*Note.* VPT = very preterm; PT = preterm; bf = breastfeeding; *SD* = standard deviation.
*A statistical difference between groups, *p* value < .05.



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countries in Europe (Callen & Pinelli, 2004). In addition, because these figures present the incidence of breastfeeding in corrected age, as opposed to postnatal age, the incidence of breastfeeding in VPT at 3 months of corrected age (62%) corresponds to a postnatal age of about 6 months.

To our knowledge, the only study that has shown an association between KMC and breastfeeding duration included preterm infants (32-36 gestational weeks) only (Hake-Brooks & Anderson, 2008). In the current study there was no such association among the PT dyads. In addition, there was no significant association between duration of KMC and exclusive breastfeeding. There are several general explanations for this lack of association. Sweden is a probreastfeeding culture where breastfeeding (exclusive or partial) is the norm, the maternal knowledge on the benefits of breast milk is high, and the early initiation of breastfeeding permeates neonatal care (Flacking et al., 2006; Flacking, Ewald, & Starrin, 2007). Therefore, a larger sample size is needed in such a setting to detect small, but statistically significant changes. Although power calculations were made, they were in relation to the original implementation study and not to breastfeeding. Another potential reason for the lack of association concerns the amount of skin-to-skin contact. The average amount of hours of KMC per day in this study was rather low (a little more than 2 hours/day). More time of KMC has previously been found to be beneficial for longer breastfeeding duration and more exclusive breastfeeding in PT infants (Hake-Brooks & Anderson, 2008), although the association between KMC and breastfeeding duration and prevalence of exclusivity has shown somewhat equivocal findings internationally. Although there was no difference in average duration of KMC per day between PT and VPT dyads, the PT infants received considerably less total time of KMC. This study adds to the evidence of the beneficial impact of KMC on breastfeeding duration. The implications of this study emphasize that it is not satisfactory that parents and their infants spend the first months of the infants' life apart, and therefore all efforts should be made to secure the parents' right to be with their infants. Hence, the spatial environment within the NICU needs to be built and structured for parents to ensure that they can be close to their infants 24 hours/day. Furthermore, by implementing KMC mothers may become more self-sufficient in mothering and breastfeeding. With the use of KMC, breastfeeding may become more pleasurable, without any demands of "succeeding" and as a fulfillment of the emotional needs of the infants and mothers, and consequently, longer breastfeeding duration (Dykes & Flacking, 2010; Flacking et al., 2006). To accomplish this goal the role of the staff

**With a supportive context, such as the provision of Kangaroo Mother Care, mothers may sustain breastfeeding for a prolonged duration.**

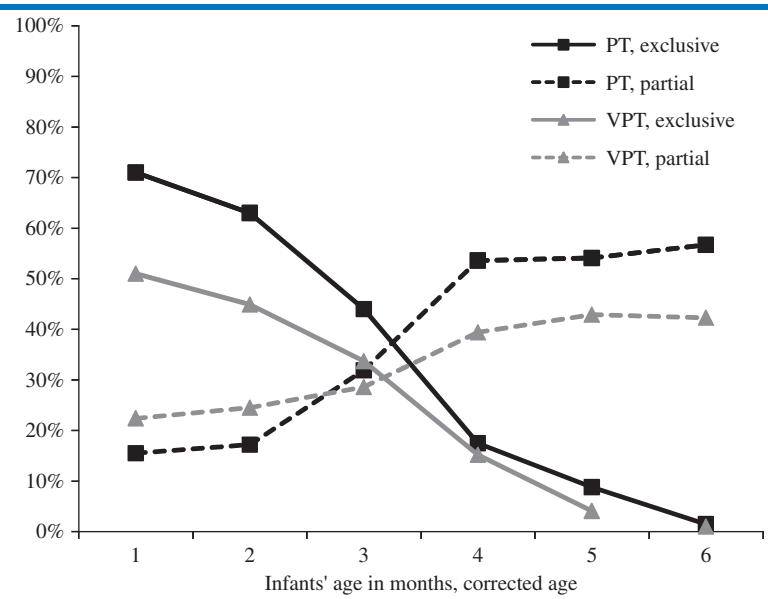


**Figure 2.** Duration of exclusive and partial breastfeeding in preterm (PT) (32-36 gestational weeks) and very preterm (VPT) (<32 gestational weeks) infants at 1 to 6 months of corrected age.

**Table 3: Method of Feeding Breast Milk in Very Preterm (VPT) and Preterm (PT) Dyads**

| | 1 Month | | 2 Months | | 3 Months | | 4 Months | | 5 Months | | 6 Months | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % | *N* | % |
| VPT | | | | | | | | | | | | |
| Only breast | 55 | 82 | 59 | 89 | 56 | 93 | 49 | 94 | 38 | 93 | 37 | 92 |
| Mixed methods | 12 | 18 | 7 | 11 | 4 | 7 | 3 | 6 | 3 | 7 | 3 | 8 |
| PT | | | | | | | | | | | | |
| Only breast | 147 | 88 | 139 | 90 | 134 | 93 | 128 | 96 | 114 | 99 | 107 | 100 |
| Mixed methods | 20 | 12 | 16 | 10 | 10 | 7 | 6 | 4 | 1 | 1 | 0 | 0 |

should be reconsidered and altered from "doing" and supervising to becoming a resource and a facilitator to parents and infants (Flacking, 2009).

Studies investigating the association between KMC time per day and salutogenic outcome measures (e.g., breastfeeding being mutually pleasurable or finding motherhood easy to adjust to) would be particularly valuable (Flacking et al., 2006; Flacking et al., 2007). Such studies would provide additional insight on the effects of KMC on the emotional aspects of breastfeeding, as well as on the transition to motherhood (Conde-Agudelo et al., 2003; Gathwala, Singh, & Balhara, 2008).

In conclusion, the positive finding in this study of the association between KMC and breastfeeding duration in VPT dyads is promising. Consequently, with a supportive context, such as the provision of KMC, mothers may feel more empowered and confident to initiate and sustain breastfeeding for a prolonged duration. Subsequently, it is highly desirable to strive for a nonseparation between mother-infant and the facilitation of KMC.

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