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# The effect of kangaroo care on breastfeeding and development in preterm neonates

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ABSTRACT

*Purpose:* This study investigated the effect of kangaroo care (KC) on breastfeeding rate and development in preterm neonates in the first six months of life.
*Design:* The study was conducted using a quasi-experimental method with a pretest-posttest control group design. The sample consisted of preterm neonates in the NICU of two state hospitals of Turkey. The experimental group ($n = 30$) was provided with KC by their mothers for 30 min once a day during a postnatal month. The control group ($n = 30$) received routine care. Feeding patterns and physical development parameters were determined during the transition to exclusive breastfeeding and at discharge, and in the first, third, and sixth postnatal months. Data were collected using a descriptive characteristics questionnaire, a nutrition and physical development follow-up form, and a home KC follow-up form. Percentage distribution, mean, chi-square test, and *t*-test were used for analysis.
*Results:* The KC group had a significantly higher mean body weight than the control group in the third and sixth postnatal months ($p < .05$). The KC group had higher breast milk intake and breastfeeding rates than the control group during the transition to exclusive breastfeeding and at discharge, and in the first, third, and sixth postnatal months ($p < .05$).
*Conclusion:* The KC neonates were breastfed for a more extended period of time than controls. This result suggests that KC improves breast milk intake and breastfeeding rates. Therefore, mothers should be trained in KC in the postnatal period.
*Practice implications:* Healthcare professionals should encourage and follow mothers for kangaroo care.
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## Introduction

The World Health Organization (WHO), the United Nations International Children's Fund (UNICEF), and the American Academy of Pediatrics (AAP) recommend exclusive breastfeeding for the first six months of age followed by nutritious complementary foods and continued breastfeeding up to the age of two years (American Academy of Pediatrics, 2020; UNICEF, 2004; World Health Organisation, 2013). Breast milk has numerous health benefits, and many countries and declarations recognize the right of children to be breastfed. However, only 39% of newborns worldwide are exclusively breastfed in the first six months of life (UNICEF, 2004). Seven in ten mothers in Turkey start breastfeeding in the first hour after birth, but only 59% exclusively breastfeed their infants in the first two months of life, decreasing rapidly with age and resulting in only 14% of infants being exclusively breastfed until four to five months of age. The average duration of exclusive breastfeeding in the first six months of age is 1.8 months (Hacettepe University Institute of Population Studies, 2018). Despite numerous health benefits of breast milk for both the infant and the mother, exclusive breastfeeding in the first six months of age is not only lower than what it needs to be but also decreases year by year. Breast milk protects the infant against diarrhea, respiratory tract infections, otitis media, astma, and sudden infant death syndrome (Salone et al., 2013). It is also argued that breastfed infants have more rapid neurological, psychomotor, and mental development than their non-breastfed peers (Victora et al., 2016).

Preterm neonates face numerous health problems because they have incomplete intrauterine development and immature systems. One of these problems is feeding. Feeding preterm neonates is extremely challenging because they are born between the 24th and 36th weeks of gestation when the fetal growth rate is highest, and therefore,

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have undeveloped gastrointestinal systems and insufficient nutritional reserves. Preterm neonates who "have a compromised immunomodulatory response, have immature organs including the brain, and are susceptible to inflammatory injury and oxidative stress" making it difficult for mothers to breastfeed their preterm neonates (Meier et al., 2013). Ideal feeding is of paramount importance for the care of preterm neonates. The American Academy of Pediatrics also recommends that preterm neonates be breastfed (American Academy of Pediatrics, 2020). However, preterm neonates have a lower breastfeeding frequency and duration than term neonates (Goyal et al., 2014; Jónsdóttir et al., 2020; Victora et al., 2016).

Various interventions are performed to improve the breastfeeding rates of preterm neonates. One of those interventions is kangaroo care (KC), which has been shown to be an effective way of helping mothers bond with their newborns, preparing for motherhood at their own pace, and increasing breastfeeding duration (Conde-Agudelo & Díaz-Rossello, 2016). Kangaroo care stabilizes the neonate's vital signs, allows for early discharge, and accelerates autonomic and neurobehavioral development in the preterm neonate. It also positively affects weight gain, prolongs breastfeeding duration, and increases breast milk intake. Preterm neonates receiving KC are breastfed for longer periods of time (Dehghani et al., 2015; Hake-Brooks & Anderson, 2008).

There are many interventions performed in Turkey to initiate and maintain successful breastfeeding. The Ministry of Health began implementing the "Promoting Breastfeeding and Baby-Friendly Hospitals" program in 1991 to encourage mothers to breastfeed. However, despite all initiatives, exclusive breastfeeding rates during the first six months of age have not improved significantly over the past decade, and early initiation of supplementary feeding is still a common practice (Hacettepe University Institute of Population Studies, 2018). What is more, Turkey, like many developing countries, has not yet recognized KC as a routine practice. Healthcare professionals encourage mothers to perform KC but do not do any post-discharge follow-up. Therefore, this study aimed to determine the effect of KC, from the neonatal intensive care unit (NICU) to the first postnatal month, on breastfeeding rate and neonatal development in preterm neonates in the first six postnatal months.

## Research hypotheses

The research hypotheses of this study are:

**$H_1$.** Preterm neonates who kangaroo care receive kangaroo care are breastfed more than those who do not receive kangaroo care in the first six postnatal months.

**$H_2$.** Preterm neonates who receive have greater body weight than those who do not receive kangaroo care.

## Material and method

### *Design and setting*

The study was conducted using a quasi-experimental method with a pretest-posttest control group design. The research was conducted between October 2015 and February 2017 in the NICUs of two state hospitals in the eastern and western parts of Turkey. Those two hospitals were the research areas of choice because the one in the west uses KC as a routine practice, while that in the east does not.

### *Sample*

The study population consisted of all preterm neonates in the two NICUs. Those who met the inclusion criteria were recruited. Power Analysis was performed using G*Power 3.1.7 (Faul et al., 2007). The result showed that a sample size of 60 would be large enough to detect significant differences (a power of 85%, an effect size of 0.8, sig 0.05). To avoid missing data, 70 preterm neonates were recruited. The sample was divided into two groups: experimental ($n = 35$) and control ($n = 35$). However, five participants from each group withdrew from the study either because the mother wanted to withdraw or could not apply KC correctly or because the infant was transferred to another hospital or had unstable health status. Therefore, the final sample consisted of 60 participants. The KC group consisted of 30 neonates and their mothers from the hospital in the west, while the control group consisted of 30 neonates and their mothers from the hospital in the east (Fig. 1).

The inclusion criteria for mothers were agreeing to participate in the study, providing KC correctly in the clinic and at home, and having no health problems and no alcohol or substance addiction.

The inclusion criteria for neonates were being born at >28 to <37 weeks of gestation, staying in the hospital at least 72 h, and having stable health status and a 5-min Apgar score of ≥7. The exclusion criteria were receiving positive pressure ventilation support, having congenital anomalies and infections, reduced body temperature and oxygen saturation during KC, and being discharged before 72 h.

### *Data collection tools*

Data were collected using a descriptive characteristics questionnaire, a Nutrition and Physical Development Follow-Up Form, and a Home Kangaroo Care Follow-Up Form.

The descriptive characteristics questionnaire was based on a literature review conducted by the researchers (Almeida et al., 2010; Yilmaz et al., 2020; Sharma et al., 2019). Three pediatric nurses were asked for their recommendations on the questionnaire content. Based on their feedback, the questionnaire consisted of items on the neonate's gender, date of birth, gestation week, body weight, body length, Apgar score, type of delivery, and the mother's age, educational status, employment status, family type, and prenatal care status.

The feeding patterns and physical development follow-up form (FPPDF) was based on a literature review conducted by the researchers (Almeida et al., 2010; Sharma et al., 2019; Yilmaz et al., 2020). Three pediatric nurses were consulted regarding the content of the form, which was then finalized based on their feedback. The form was used to record feeding patterns and methods, and body height and weight in neonates during the transition to exclusive breastfeeding and at discharge, and in the first, third, and sixth postnatal months.

The Home Kangaroo Care Follow-Up Form (HKCFUF) was based on a literature review conducted by the researchers (Almeida et al., 2010; Boo & Jamli, 2007; Moore et al., 2012; Sharma et al., 2019). Three pediatric nurses were consulted regarding the content of the form, which was then finalized based on their feedback. The form was used to record at what time mothers started KC and how long they did it every day for a month. The one-month data were written as a table in rows. The daily onset and duration of KC were recorded next to the corresponding day on the same table. The mothers were handed out the forms and instructed on how to fill them out.

### *Procedure*

All data were collected at the same time. The mothers of NICU neonates who met the inclusion criteria were informed about the research purpose and procedure prior to participation, and verbal and written informed consents were obtained from those who agreed to participate. Both hospitals were baby-friendly hospitals, and therefore, their healthcare professionals trained all participating mothers on breast milk and breastfeeding as they routinely do.

### *Experimental group*

The experimental neonates received KC when they achieved a stable health status (vital signs are within normal limits and in a calm state).

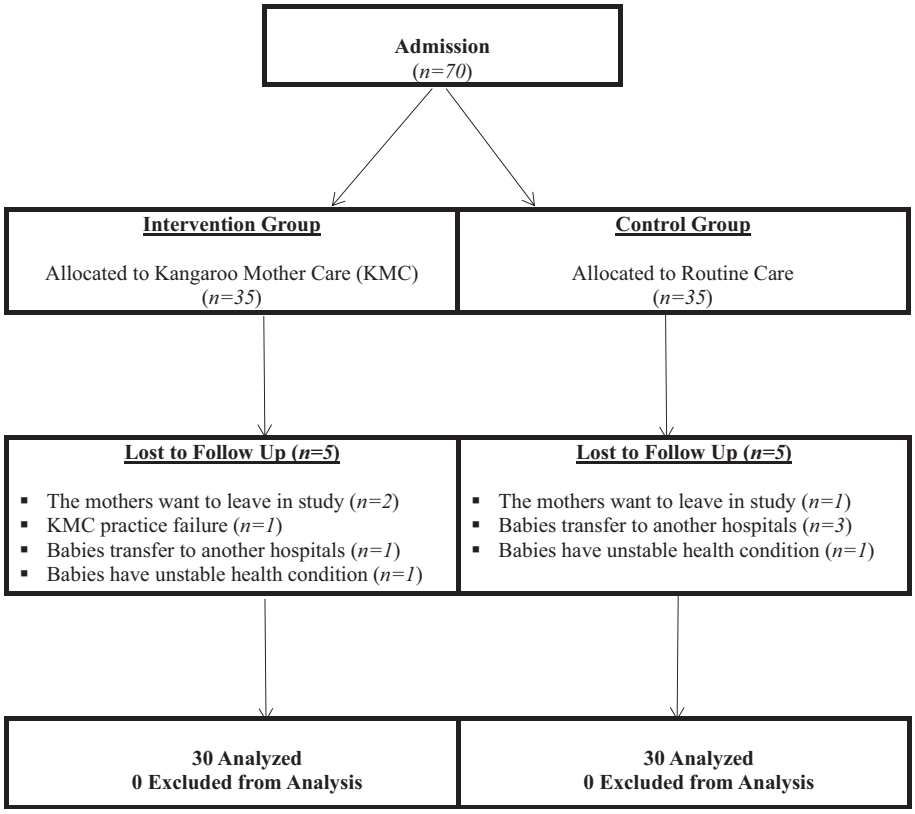



**Fig. 1.** Flow chart of the study.

A neonatologist physician in the same clinic determined their health status and decided on the onset of KC. Prior to KC, the researcher trained the mother on KC for about an hour in the clinical training room in line with the recommendations of the World Health Organization (World Health Organisation, 2003). The content of the training consisted of the purpose, technique, target group, and practitioners of KC, and points to take into consideration (body cleaning before visiting the clinic, wearing clean and comfortable clothes, not wearing jewelry, perfume, or deodorant, and meeting these conditions at home as well). The researcher used an infant simulator during the KC training and then evaluated how well the mother performed KC by herself.

The KC mother provided KC to her baby every day during the hospital stay and until the end of the first month after discharge. She provided KC for 30 min in the afternoon at least once a day, as recommended by the WHO (World Health Organisation, 2003).

The KC mother performed the first KC session with the help of the researcher. She performed the subsequent KC sessions by herself under the supervision of the researcher. The room temperature was 24–26 °C (Jia et al., 2013). The mother was comfortably seated on the chair next to the incubator. The infant was placed over the mother's bare breast horizontally and in a prone position. The infant was wearing a diaper and a hat. The back of the infant was covered with a presterilized and warmed clean wrap. The mother supported the infant's back and bottom. The environmental stimuli (noise, personnel mobility, light, etc.) that might disturb the mother and the infant during KC were kept to a minimum.

After the neonate was discharged, the researcher conducted the home visit to make sure that the mother continued to provide KC and arranged the home setting accordingly. The researcher informed the mother about the suitable physical conditions (room temperature 24–26 °C, noise, and light control, performing KC in the same room and at the same time). The mother performed the first at-home KC session under the supervision of the researcher. The researcher gave the mother a thermometer and asked her to check the room temperature before KC and make sure that the room temperature was suitable.

*Data collection procedures: experimental group*

The researcher collected the data from patients' files and face-to-face interviews (with the mothers) and recorded them in the descriptive characteristics questionnaire. Afterward, the mothers performed KC. The researcher recorded the KC data (time and duration) in the NICUs and then handed out the HKCFUF forms after discharge. The mothers recorded on the HKCFUF forms the daily time and duration of KC. They filled out the forms for one month (until the end of the first postnatal month).

The researcher measured the neonates' body weight and length and interviewed the mothers in the hospital to record the feeding patterns and methods in the first KC session during the transition to exclusive breastfeeding and at discharge. After discharge, the researcher called the mothers to collect data on feeding patterns and methods in the first, third, and sixth postnatal months and recorded it on the FPPDF. In Turkey, infant development is followed up by Family Health Centers. Body weight and length in the first, third, and sixth postnatal months were measured at family health centers. Body weight was measured using a balance sensitive to 10 g. The neonate was undressed except for its diaper, which was changed just before the measurement. During the measurement, the researcher stood next to the neonate to keep it from falling and kept one of her hands on it without touching it. The neonate was moved to an examination table in the unit, and its body length was measured in the supine position using a head & footboard. The headboard was fixed, while the footboard was movable. The head of the neonate (vertex) touched the headboard, and its feet touched the footboard, with the knees straight and the ankle joint at a 90° angle to the leg. The length measured by a ruler was read at the level where the movable footboard was located.

**Table 1**
Comparison of experimental and control groups according to descriptive characteristics.

| *Descriptive characteristics* | *Control group* (n = 30) X ± SD* | *Experimental group* (n = 30) X ± SD* | *Test & p* |
|---|---|---|---|
| Mother's age | 31.80 ± 6.88 | 30.40 ± 7.36 | $t = -0.76$ $p = .45$ |
| Infant's gestation week | 32.93 ± 2.40 | 32.43 ± 2.51 | $t = -0.78$ $p = .43$ |
| Infant's birth weight (gr) | 1999 ± 500.0 | 1995.50 ± 576.2 | $t = -0.02$ $p = .97$ |
| Infant's length (cm) | 44.13 ± 3.41 | 44.83 ± 3.84 | $t = 0.74$ $p = .45$ |
| Apgar score (1 min) | 6.90 ± 0.88 | 7.16 ± 0.83 | $t = 1.20$ $p = .23$ |
| Apgar score (5 min) | 8.10 ± 0.80 | 8.20 ± 0.76 | $t = 0.49$ $p = .62$ |
| Period of time in the hospital (day) | 22.70 ± 20.02 | 23.60 ± 24.33 | $t = 0.156$ $p = .88$ |
| Infant's gender | ***n %*** | ***n %*** | $x^2 = 3.20$ |
| Female | 18 60 | 11 36.7 | $p = .07$ |
| Male | 12 40 | 19 63.3 | |
| Birth Method | | | |
| Vaginal | 10 33.3 | 10 33.3 | $x^2 = 0.00$ |
| Caesarean | 20 66.7 | 20 66.7 | $p = 1.00$ |
| Number of births | | | |
| Primipar | 12 40 | 14 46.7 | $x^2 = 2.02$ |
| Multiparous | 18 60 | 6 53.3 | $p = .73$ |
| Education Status | | | |
| Primary | 21 70 | 14 46.6 | $x^2 = 6.13$ |
| Secondary | 6 20 | 7 23.3 | $p = .18$ |
| High education | 3 10 | 9 30.1 | |
| Working status | | | |
| Working | 6 20 | 4 13.3 | $x^2 = .48$ |
| Housewife | 24 80 | 26 86.7 | $p = 0.48$ |
| Family type | | | |
| Extended | 2 6.7 | 6 20 | $x^2 = 3.17$ |
| Core | 27 90 | 24 80 | $p = .20$ |
| Fragmented | 1 3.3 | - - | |

* Mean and standard deviation. *t*=Independent sample t test, $X^2$= Chi-square,

*Control group*

The control group received routine care, and the control group mothers were not instructed on whether to perform KC or not.

*Data collection procedures: control group*

The researcher collected the data from patients' files and face-to-face interviews (with the mothers) and recorded them in the descriptive characteristics questionnaire. The researcher measured the neonates' body weight and body length and determined the feeding patterns and feeding method during the transition to exclusive breastfeeding and at discharge. After discharge, the researcher called the mothers to collect data on feeding patterns and methods in the first, third, and sixth postnatal months and recorded it on the FPPD.

*Data analysis*

Data were analyzed using the Statistical Package for Social Sciences (SPSS version 18) at a significance level of 0.05. Percentage distribution, mean, chi-square test, and *t*-test were used for analysis.

*Ethical considerations*

The study was approved by an ethics committee, and permission was obtained from the hospitals prior to research. The mothers were informed about the purpose, procedure, and benefits of the study prior to participation, and verbal informed consent was obtained from those who agreed to participate. The study satisfied the principles of voluntary participation and informed consent.

## Results

All participating neonates had a similar gestational age, gender, birth weight, body length, 1-min and 5-min Apgar scores, maternal age and period of time in the hospital of infants (Table 1, $p > .05$). All participating mothers had similar mean age, education and employment status, family type, type of delivery, and the number of children (Table 1, $p > .05$).

Fig. 2 shows the 1–6-month exclusive breast milk intake percentages of the KC and control groups. The KC group had exclusive breast milk intake of 73.3%, 73.3%, 60.0%, 43.3%, and 26.7% during the transition to exclusive breastfeeding, at discharge, and in the first, third, and sixth postnatal months, respectively. The control group had exclusive breast milk intake of 13.3%, 20.0%, 13.3%, 13.3%, and 6.7% during the transition to exclusive breastfeeding, at discharge, and in the first, third, and sixth postnatal months, respectively.

Fig. 3 shows the body weight of the experimental and control neonates. Both groups had similar body weight during the transition to exclusive breastfeeding, at discharge, and in the first postnatal month. However, the KC neonates had greater body weight than controls in the third and sixth postnatal months.

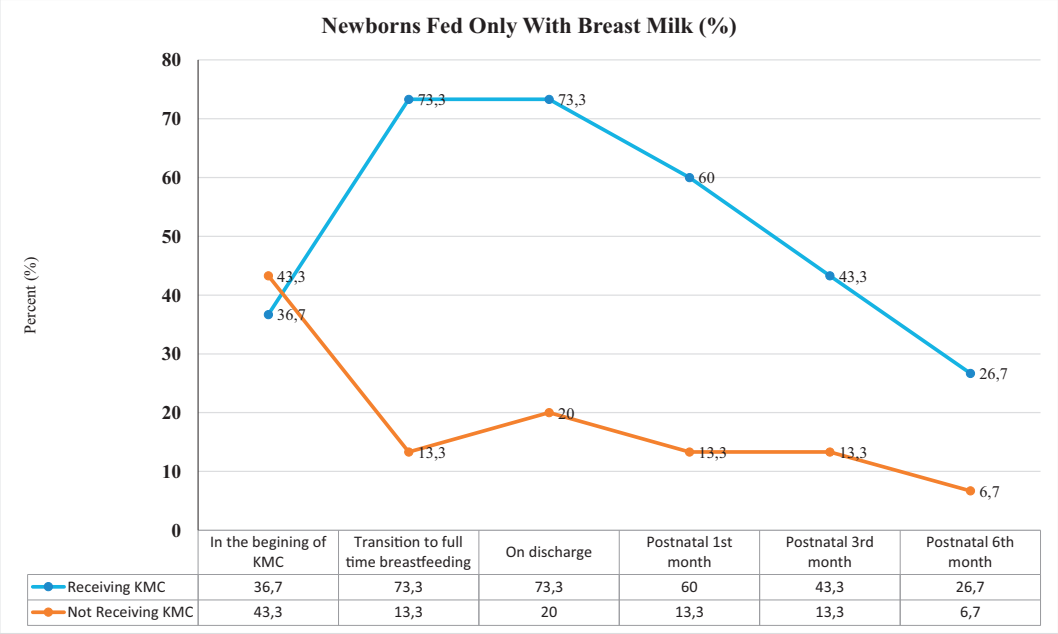



**Fig. 2.** Nutritional percentages of preterms in the first six months only with breast milk in experimental (receiving KMC) and control groups (not receiving KMC).

Table 2 compares the body weight, body length, feeding patterns, and feeding method of both groups until the sixth postnatal month. In the first measurement, the two groups had similar values ($p > .05$). There were no significant differences in body weight and body length between the two groups during the transition to exclusive breastfeeding, at discharge, and in the first postnatal month. However, the KC group had greater body weight and body length than controls in the third and sixth postnatal months. The KC group had significantly higher exclusive breastfeeding rates than controls during the transition to exclusive breastfeeding, at discharge, and in the first and third postnatal months. The KC group had higher values in all parameters but body length than controls in the sixth postnatal month (Table 2, $p < .001$).

Table 3 shows the feeding patterns in both groups in the sixth postnatal month. The KC neonates (26.7%) had significantly greater exclusive breast milk intake than controls (6.7%) ($p < .05$).

## Discussion

Kangaroo care has considerable health benefits for both the mother and the infant because it reduces the risk of morbidity and mortality, involves family members in the care of their infants, and promotes the mother-infant bond and breastfeeding (Conde-Agudelo et al., 2016; Yilmaz et al., 2020). Although there is a large body of research exploring the effects of KC, there is little retrospective research on the effect of KC on breastfeeding style and development among neonates in the first six months of life (Flacking et al., 2011; Nyqvist et al., 2010). This study investigated the effect of KC on breastfeeding style and development among preterm neonates in the first six months of life. The results indicated a relationship between KC and breast milk intake/breastfeeding rate. The KC neonates had greater breast milk intake than controls at discharge and in the first, third, and sixth postnatal months (Table 2, 3). Although breastfeeding is the gold standard for infant feeding and

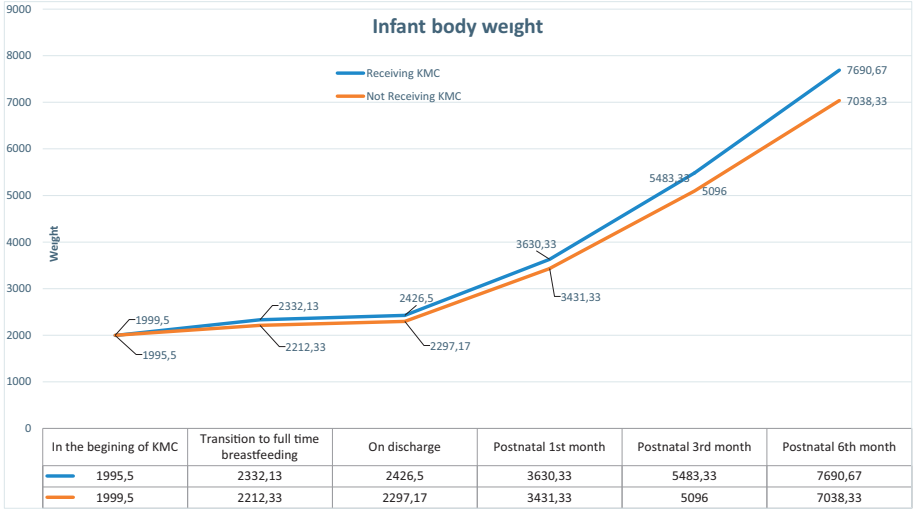



**Fig. 3.** Body weights of preterms in the first six months in experimental (receiving KMC) and control groups (not receiving KMC).

**Table 2**
Comparison of preterm infants receiving and not receiving KC in terms of nutrition, body weight, length, feeding pattern and feeding method.

| *Time* | *Body weight (gr)* | *Length (cm)* | *Feeding pattern* | | | | | | | | *Feeding method* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *Breastmilk/natural nutrition* | | *Formula milk/artificial nutrition* | | *Breastmilk/mixed nutrition* | | *Breast feeding* | | *Bottle. spoon* | | *Both methods work together* | |
| | *X ± SD* | *X ± SD* | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* |
| **In the beginning of KMC** | | | | | | | | | | | | | | |
| Exp | 1995.50 ± 576.30 | 44.83 ± 3.84 | 11 | 36.7 | 10 | 33.3 | 9 | 30.0 | 2 | 6.7 | 26 | 86.7 | 2 | 6.7 |
| Cont | 1999.50 ± 508.38 | 44.13 ± 3.41 | 13 | 43.3 | 11 | 36.7 | 6 | 20.0 | 1 | 3.3 | 25 | 83.3 | 4 | 13.3 |
| **Test & *p*** | t = 0.029† | t = 0.746† | $X^2$ = 5.430†† | | | | | | | | $X^2$ = 1020†† | | | |
| | *p* = .977 | *p* = .459 | *p* = .143 | | | | | | | | *p* = .601 | | | |
| **In transition to full breastfeeding** | | | | | | | | | | | | | | |
| Exp | 2332.13 ± 410.19 | 46.63 ± 2.94 | 22 | 73.3 | 0 | 0.0 | 8 | 26.7 | 13 | 43.3 | 1 | 3.3 | 16 | 53.3 |
| Cont | 2212.33 ± 377.35 | 45.60 ± 3.33 | 6 | 20.0 | 3 | 10.0 | 21 | 70.0 | 0 | 0.0 | 6 | 20.0 | 24 | 80.0 |
| **Test & *p*** | t = 1.777† | t = 1.274† | **$X^2$ = 22.720††** | | | | | | | | **$X^2$ = 18.171††** | | | |
| | *p* = .244 | *p* = .208 | ***p* = .001** | | | | | | | | ***p* = .001** | | | |
| **On discharge** | | | | | | | | | | | | | | |
| Exp | 2426.50 ± 390.13 | 47.27 ± 2.74 | 22 | 73.3 | 0 | 0.0 | 8 | 26.7 | 21 | 70.0 | 0 | 0.0 | 9 | 30.0 |
| Cont | 2297.17 ± 396.48 | 46.80 ± 3.32 | 6 | 20.0 | 3 | 10.0 | 21 | 70.0 | 2 | 6.7 | 2 | 6.7 | 26 | 86.7 |
| **Test & *p*** | t = 1.274† | t = 0.5594† | **$X^2$ = 17.970††** | | | | | | | | **$X^2$ = 25.953††** | | | |
| | *p* = .208 | *p* = .555 | ***p* = .001** | | | | | | | | ***p* = .001** | | | |
| **1 month after discharge** | | | | | | | | | | | | | | |
| Exp | 3630.33 ± 690.82 | 50.40 ± 2.70 | 18 | 60.0 | 1 | 3.3 | 11 | 36.7 | 18 | 60.0 | 2 | 6.7 | 10 | 33.3 |
| Cont | 3431.33 ± 568.14 | 50.83 ± 2.87 | 4 | 13.3 | 18 | 60.0 | 8 | 26.7 | 3 | 10.0 | 15 | 50.0 | 12 | 40.0 |
| **Test & *p*** | t = 1.219† | t = 0.603† | **$X^2$ = 24.593††** | | | | | | | | **$X^2$ = 20.837††** | | | |
| | *p* = .228 | *p* = .549 | ***p* = .001** | | | | | | | | ***p* = .001** | | | |
| **3 months after discharge** | | | | | | | | | | | | | | |
| Exp | 5483.33 ± 706.57 | 56.50 ± 3.63 | 13 | 43.3 | 4 | 13.3 | 13 | 43.3 | 13 | 43.3 | 6 | 20.0 | 11 | 36.7 |
| Cont | 5096.00 ± 778.79 | 56.63 ± 2.83 | 4 | 13.3 | 21 | 70.0 | 5 | 16.7 | 3 | 10.0 | 21 | 70.0 | 6 | 20.0 |
| **Test & *p*** | t = 2.018† | t = 0.159† | **$X^2$ = 19.880††** | | | | | | | | **$X^2$ = 16.054††** | | | |
| | ***p* = .048** | *p* = .874 | ***p* = .001** * | | | | | | | | ***p* = .001** | | | |
| **6 months after discharge** | | | | | | | | | | | | | | |
| Exp | 7690.67 ± 1148.55 | 63.73 ± 3.99 | | | | | | | 8 | 26.7 | 9 | 30.0 | 13 | 43.3 |
| Cont | 7038.33 ± 629.54 | 64.77 ± 2.11 | | | | | | | 2 | 6.7 | 24 | 80.0 | 4 | 13.3 |
| **Test & *p*** | t = 2.728† | t = 1.25†3 | | | | | | | | | **$X^2$ = 15.183††** | | | |
| | ***p* = .008** | *p* = .215 | | | | | | | | | ***p* = .001** | | | |

**Exp** = Experimental group (*n* = 30); **Cont** = Control group.
* Comparison of feeding patterns of preterm infants with and without KC is detailed in Table 3.
†† = Chi-square.
† = t-test, p<0.001.

exclusive breastfeeding is recommended in the first six months of life, most neonates today are fed exclusively with formula or breast milk plus formula due to maternal and/or infant-related reasons. Jónsdóttir et al. (2020) compared breastfeeding progression in late preterm infants from birth to one month. Term infants were more likely to be exclusively breastfed at the breast compared with late preterm infants (Jónsdóttir et al., 2020). According to the Hacettepe University Institute of Population Studies, 71% of infants are breastfed within the first hour after birth, whereas only 14 of infants four to five months of age and only 4% of infants six to eight months of age are exclusively breastfed (Hacettepe University Institute of Population Studies, 2018). In recent years, KC has been a popular method for successful and extended breastfeeding (Flacking et al., 2011; Mekonnen et al., 2019; Phillips, 2013; Sharma et al., 2019).

Feeding in kangaroo care is based on breast milk. Research shows that neonates who receive KC are more likely to be breastfed early and exclusively for longer periods of time and consume more breast milk than those who do not receive KC. Our KC neonates had greater

**Table 3**
Comparison of feeding patterns of preterm infants with and without KC.

| *Feeding pattern* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *6 months after discharge* | *Breastmilk/natural nutrition* | | *Formula milk/artificial nutrition* | | *Breastmilk/mixed nutrition* | | *Breastmilk + additional foods* | | *Formula milk/additional foods* | |
| | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* |
| Exp | 8 | 26.7 | 1 | 3.3 | 4 | 13.3 | 10 | 33.3 | 7 | 23.3 |
| Cont | 2 | 6.7 | 11 | 36.7 | 1 | 3.3 | 2 | 6.7 | 14 | 46.7 |
| **$X^2$ = 21.400††** | | | | | | | | | | |
| ***p* = .001** | | | | | | | | | | |

**Exp** = Experimental group (*n* = 30); **Cont** = Control group
†† = Chi-square.

exclusive breast milk intake during the transition to exclusive breastfeeding, at discharge, and in the first, third, and sixth postnatal months than controls (Fig. 2). Flacking et al. (2011) found that neonates who received KC had breast milk intake of 71%, 63%, 44%, 18%, 9%, and 2% after discharge and in the first, second, third, fourth, fifth, and sixth postnatal months, respectively (Flacking et al., 2011). Zhang et al. (2020) looked into the effect of KC on breastfeeding rates among preterm neonates ($n = 627$) in China, where breastfeeding rates are generally low. They reported that those who received KC were exclusively breastfed, at both discharge and 42-days follow-up, almost twice as often as those who did not receive KC.

Boo and Jamli (2007) found that very LBW neonates who received at least one hour of KC per day in a NICU had higher breastfeeding rates than those who did not. Zhang et al. (2020) and Ali et al. (2009) reported that LBW infants who received KC were likely to be exclusively breastfed for a longer period of time than those who did not (Ali et al., 2009; Zhang et al., 2020). Nyqvist et al. (2010) and Moore et al. (2012) found that neonates who received KC before being discharged from a NICU were exclusively breastfed more and for a longer period of time than those who did not (Yilmaz et al., 2020; Moore et al., 2012). Our results are consistent with those reported by earlier studies, suggesting that KC improves breastfeeding in neonates. This result confirms $H_1$ hypothesis.

Kangaroo care also increases breast milk production, resulting in body weight gain in neonates (Dehghani et al., 2015). Research also shows that KC improves sucking and body weight gain in neonates. Shrivastava et al. (2013) argue that routine KC positively affects development, body weight and length, and head circumference during the first two years of life (Shrivastava et al., 2013). Ali et al. (2009) compared KC and conventional care among LBW neonates and found that KC resulted in more weight gain and did not adversely affect development (Ali et al., 2009). Kurniawati et al. (2019) reported that LBW infants who received KC in the first five days after birth gained more weight than those who did not receive KC. Our KC neonates had higher body weight gain in the third and sixth postnatal months than controls (Table 2, Fig. 3). This result confirms $H_2$ hypothesis. However, the KC and control groups had similar body weight at discharge and in the first postnatal month. Therefore, the difference in body weight between the third and sixth postnatal months may have been due to KC or maternal and/or infant-related or environmental factors. Some studies show that KC has a positive effect on development, while some others argue that KC does not affect body weight gain in neonates (Ghavane et al., 2012; Sarıcan, 2014; Yıldırım, 2009). Therefore, we believe that more research with larger samples is warranted to better understand the effect of KC on neonatal development.

## Practice implications

Kangaroo care should be a routine practice in clinics to improve breastfeeding rates among preterm neonates. Before discharge, healthcare professionals should teach mothers how to provide KC to their babies and encourage them to keep on doing so at home as well. Clinics should also provide in-service training in KC to healthcare professionals who perform pediatric measurements and follow mothers up to make sure that they provide KC to their babies at home.

## Limitations

One of the limitations of this study is that the researcher administered the intervention and collected the data. The other limitation was that although the researcher was able to supervise the mothers performing KC in the hospital, she followed up their KC performance at home only through telephone calls, except for the first home visit. Another limitation is the KC and control groups were from separate hospitals thereby limiting the generalizability of study findings.

## Conclusion

This study investigated the effect of KC on breastfeeding rates and development in preterm neonates in the first six months of life. Kangaroo care increased breastfeeding rates in preterm neonates. The KC and no-KC neonates had similar body weight in the first postnatal month, but the latter had greater body weight in the third and sixth postnatal months than the former. The KC and no-KC neonates also had similar body length in the first, third, and sixth postnatal months.

As the findings of this study suggest, kangaroo care improves breast milk intake, and therefore, should be a routine practice in NICUs. Necessary environment and support should be provided to encourage mothers to perform KC to promote mother-infant attachment. Moreover, healthcare professionals should encourage mothers to continue providing KC to their infants regularly, especially in the first months after birth. Future studies should identify the factors that promote and inhibit the use of routine KC in intensive care units in developing countries.

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## CRediT authorship contribution statement

**Sibel Kucukoglu**: Conceptualization, Methodology, Software, Data curation, Supervision, Writing - review & editing. **Fatma Yılmaz Kurt**: Conceptualization, Methodology, Software, Data curation, Writing - original draft. **Aynur Aytekin Ozdemir**: Conceptualization, Methodology, Writing - original draft, Supervision, Writing - review & editing. **Zekiye Ozcan**: Conceptualization, Methodology, Writing - original draft.

## Declaration of Competing Interest

The author declares no conflict of interest concerning the research, authorship and publication of this article.

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