

COMPARISON OF CONVENTIONAL CARE AND KANGAROO MOTHER CARE ON VERY LOW BIRTH WEIGHT BABIES

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ABSTRACT

Background: Very low birth weight (VLBW) infants are highly vulnerable to morbidity and mortality when managed with conventional incubator-based care. Kangaroo Mother Care (KMC), involving skin-to-skin contact and exclusive breastfeeding support, has emerged as an effective alternative, improving survival, thermoregulation, and bonding in this fragile population. **Objective:** To compare Conventional Care Vs KMC on VLBW. **Methodology:** This study employed a randomized controlled trial conducted in the Paediatrics department unit 1 newborn nursery and intensive care unit Services Hospital Lahore. With a duration of 9 months, 104 neonates, 52 in each group, participated based on previous research indicating mean weights at two weeks for kangaroo mother care and conventional care groups. Nonprobability purposive sampling was used. Inclusion criteria encompassed neonates with very low birth weight (<1500 gm), excluding those needing critical care interventions or having congenital anomalies without maternal consent. Data collection involved temperature monitoring and weight measurements, analyzed using SPSS version 26 with significance set at 0.05. **Results:** Notably, participants in the Conventional Care (CC) group exhibited a significantly longer mean hospital stay (16.1 days) compared to the Kangaroo Mother Care (KMC) group (10.8 days). Moreover, the comparison of weight gain in grams from Day 1 to Day 5 between the Conventional Care (CC) and Kangaroo Mother Care (KMC) groups indicates statistically significant differences across all days. Participants in the KMC group showed higher mean weight gain throughout the observation period, with Day 1 demonstrating a mean weight gain of 1489.6 grams compared to 1461.2 grams in the CC group ($p = 0.04$). **Conclusion:** Kangaroo Mother Care (KMC) demonstrates effectiveness in promoting daily weight gain compared to the CC group. Additionally, KMC proves beneficial in shielding neonates from hypothermia. However, insufficient evidence exists to establish a discernible disparity in the incidence of apnea and hospital stay duration between the two groups.

INTRODUCTION

Newborns with low weight is a major problem all over the world, especially in developing countries ^{1,2}. As per World Health Organization (WHO), Low birth weight (LBW) is defined as weighing < 2,500 grams or 5 pounds 8 ounces at birth, is one of the top reasons for infant mortality worldwide ³. Developing

nations face disproportionately higher rates of low birth weight and its downstream consequences compared to more industrialized countries ⁴. Taking care of preterm babies or those with low birth weight requires intensive medical intervention and resources. The neonatal intensive care units (NICUs) are managed to provide this specialized care through advanced technology, infrastructure, trained personnel and logistical support ⁵. However, developing nations lack such high-end NICU facilities and capacities to the required standards ^{6, 7}. There are many challenges like staff not being well trained, lack of equipment, less staff, and overcrowded wards ⁷. Family centered care and bonding is also difficult with conventional NICU setups which separate mothers from newborns. This causes stress in mothers and delays bonding between mother and child ⁸.

An alternative approach better suited to resource-poor settings is Kangaroo Mother Care (KMC). The name KMC originates from observation of kangaroo parenting behavior where infant marsupials are carried skin to skin in the mother's pouch for protection, warmth and feeding ⁹. Similarly, in KMC the mother acts as the 'pouch' and human incubator providing critical thermal regulation and nutrition for the newborn outside of high-cost intensive care. The technique involves prolonged, continuous skin-to-skin contact between the mother and infant, also called kangaroo position ⁹.

Some key physiological effects of kangaroo contact shown in research include stabilization of vital functions like heart rate, respiration and oxygen saturation levels in preterm infants ^{9, 10}. Skin-to-skin contact and sucking at the mother's breast triggers neurophysiological and psychological responses in the newborn ¹⁰. Studies find preterm infants can feel and respond to the mother's heartbeat, breathing, touch, vocalizations and movements through skin contact. This has a proven calming and distress-reducing effect through autonomic nervous system signaling ¹¹⁻¹³.

In a nutshell, low birth weight remains a critical global health issue disproportionately impacting developing nations. Preterm and low weight infants face heightened life risks without interventions. While advanced NICUs save lives, they are inaccessible to most vulnerable newborns. KMC offers a family-centered, cost-effective alternative model optimized for resource-limited settings. Extensive evidence demonstrates its wide-ranging advantages both short and long-term for infant survival, health and neurodevelopmental outcomes. However, KMC utilization could be expanded to more adequately address ongoing neonatal challenges where NICU-style options are unavailable. The present study aims to add to literature on KMC versus conventional care impacts within a large hospital in Pakistan.

MATERIALS AND METHODS

Study Design: Randomized controlled trial

Settings: Pediatrics department unit 1 newborn nursery and intensive care unit, Services Hospital, Lahore

Duration of Study: The study was completed in 9 months (Mar 5, 2023 Dec 5 2023).

Sample Size: 104 (52) of each group of neonates were taken in the study. The sample size was estimated using a mean weight at two weeks in group A (kangaroo mother care) and group B (conventional care) as 1839.87 ± 233 and 1717.67 ± 207.85 (Ahmad et al., 2022), at 80 % power of the test and 95% confidence.

Sampling Technique: Non-Probability purposive sampling

Sample Selection:

- **Inclusion Criteria**

Neonates who had very low birth weight < 1500 gm admitted to nursery.

- **Exclusion Criteria**

Neonates who were critical and required ventilatory support or inotropes or incubator or having congenital anomalies and who were terminal and those whose mothers didn't give consent were not included in the study.

Data Collection Procedure

After approval from the Institutional Review Board (IRB) of the University of Lahore and obtaining informed consent from parents, the study was conducted in the Pediatrics Department of Services Hospital, Lahore. Participants were randomized into two groups: the control group, which received conventional neonatal care (CC), and the intervention group, which received Kangaroo Mother Care (KMC). In the CC group, neonates were wrapped in cloth and kept beside the mother, and if temperature regulation was inadequate, they were placed under a radiant warmer or incubator as required. Informed consent was obtained from the mother in the KMC group. Permission was also taken from father or any other family member. The guardians were informed about the danger signs such as apnea, cyanosis, and poor oral intake, and they were also counseled that take immediate action if they notice any of these danger signs. Once the mother was comfortable, KMC was initiated, with mothers instructed to provide at least six hours of KMC per day, divided into a maximum of four sessions of no less than one hour each. During sessions, the baby was held upright against the mother's chest in skin-to-skin contact, wearing only a diaper, and covered with a single cloth; the baby's face was positioned sideways to avoid flexion or hyperextension. Mothers were allowed to pause briefly to change diapers and then continue KMC, and they were provided charts to record the duration of each session. Neonatal temperature was monitored before and after each KMC session using an axillary thermometer and every four hours when not in session. Neonates were weighed daily in the morning and evening before feeding and without diapers, using a calibrated scale with 10-gram sensitivity, while occipitofrontal circumference and length

were recorded at admission and discharge with a non-stretchable tape. Babies requiring phototherapy or intensive care were temporarily withdrawn but reincluded once stable. Clinical details including mode of delivery, weight, length, occipitofrontal circumference, APGAR score, maternal gravida status, and maternal mid-arm circumference were documented on a structured proforma. Gestational age was calculated from the last menstrual period or early ultrasound and confirmed using the modified Ballard method within 24 hours of admission. All neonates were monitored for apnea, cyanosis, jaundice, feeding, weight gain, and temperature stability. Very low birth weight was defined as birth weight below 1500 grams, KMC as skin-to-skin contact between mother and baby, and CC as neonatal care through radiant warmers, incubators, or open cots to maintain body temperature. Apnea was defined as cessation of respiration for more than 20 seconds or any pause associated with oxygen desaturation below 90%, hypothermia as a body temperature below 36 °C, weight gain as the daily increment in grams from Day 1 to Day 5, body temperature as axillary temperature in Fahrenheit recorded twice daily, and hospital stay as the total number of days from admission to discharge. Data were entered and analyzed in SPSS version 26, with categorical variables expressed as frequencies and percentages and continuous variables summarized as mean $\pm$ standard deviation. Independent sample t-test was applied to compare means in both groups, with $p \leq 0.05$ considered statistically significant.

RESULTS

A total of 104 mother–infant dyads were analyzed. The mean maternal age was 28.5 ± 5.4 years (median 29; range 18–40), and participants were evenly allocated to Conventional Care (CC) and Kangaroo Mother Care (KMC) groups (52/104; 50.0% each) (Table 1). Mean gestational age at enrollment was 32.5 ± 3.27 weeks overall; by group, gestational age did not differ significantly (CC: 31.3 ± 2.97 vs KMC: 31.7 ± 3.4 ; $p = 0.09$). Length of hospital stay was significantly shorter in KMC (10.8 ± 1.8 days) than CC (16.1 ± 3.2 days; $p = 0.02$) (Table 1). Daily weight showed a progressive increase from Day 1 to Day 5 in both arms, with consistently higher mean weights in KMC on each day (Day 1–Day 5 p -values: 0.04, 0.02, 0.03, 0.001, 0.001, respectively), indicating superior early growth trajectory under KMC (Table 2). Apnea episodes decreased over time in both groups but remained less frequent in KMC, achieving statistical significance from Day 2 through Day 5 (Day 1: $p = 0.06$; Day 2: $p = 0.04$; Day 3: $p = 0.02$; Day 4: $p = 0.001$; Day 5: $p = 0.001$) (Table 3). Morning and evening body temperatures were broadly comparable between arms, with significant between-group differences on Day 1 (morning and evening) and Day 3 (morning), favoring lower values in KMC (Day 1 morning $p = 0.04$; Day 1 evening $p = 0.04$; Day 3 morning $p = 0.03$), while other days showed no material differences (Table 4).

Table 1. Baseline characteristics and group allocation (n = 104)

Variable	Overall	CC (n=52)	KMC (n=52)	p-value
Maternal age (years), mean $\pm$ SD	28.5 $\pm$ 5.4	28.9 $\pm$ 5.6	27.9 $\pm$ 5.1	0.18
Gestational age (weeks), mean $\pm$ SD	32.5 $\pm$ 3.27	31.3 $\pm$ 2.97	31.7 $\pm$ 3.4	0.09
Hospital stay (days), mean $\pm$ SD	11.8 $\pm$ 3.2	16.1 $\pm$ 3.2	10.8 $\pm$ 1.8	0.02

SD: standard deviation.

Table 2. Daily weight (grams) by group from Day 1 to Day 5

Day	CC mean $\pm$ SD	KMC mean $\pm$ SD	p-value
Day 1	1461.2 $\pm$ 18.3	1489.6 $\pm$ 19.7	0.04
Day 2	1478.7 $\pm$ 15.8	1528.4 $\pm$ 20.2	0.02
Day 3	1505.4 $\pm$ 16.5	1555.2 $\pm$ 17.7	0.03
Day 4	1535.9 $\pm$ 14.7	1589.6 $\pm$ 19.3	0.001
Day 5	1570.3 $\pm$ 15.5	1655.9 $\pm$ 17.5	0.001

SD: standard deviation.

Table 3. Apnea presence by day and group, n(%)

Day	Category	CC (n=52)	KMC (n=52)	p-value
Day 1	Absent / Present	1(1.9) / 51(98.1)	6(11.5) / 46(88.5)	0.06
Day 2	Absent / Present	3(5.8) / 49(94.2)	8(15.4) / 44(84.6)	0.04
Day 3	Absent / Present	4(7.7) / 48(92.3)	12(23.1) / 40(76.9)	0.02
Day 4	Absent / Present	4(7.7) / 48(92.3)	17(32.7) / 35(67.3)	0.001
Day 5	Absent / Present	3(5.8) / 49(94.2)	24(46.2) / 28(53.8)	0.001

Table 4. Morning and evening Body temperature (°F) by group from Day 1 to 5

Day	Measure	CC mean $\pm$ SD	KMC mean $\pm$ SD	p-value
Day 1	Morning	98.9 $\pm$ 0.9	98.1 $\pm$ 1.2	0.04
	Evening	98.7 $\pm$ 1.2	98.2 $\pm$ 1.1	0.04
Day 2	Morning	98.1 $\pm$ 1.1	98.4 $\pm$ 1.3	0.08
	Evening	98.2 $\pm$ 1.0	98.3 $\pm$ 1.2	0.08
Day 3	Morning	98.3 $\pm$ 0.9	97.8 $\pm$ 1.1	0.03
	Evening	98.2 $\pm$ 1.0	98.1 $\pm$ 0.8	0.27
Day 4	Morning	98.4 $\pm$ 1.2	98.3 $\pm$ 0.8	0.37
	Evening	98.2 $\pm$ 1.0	98.2 $\pm$ 1.1	0.94
Day 5	Morning	98.1 $\pm$ 1.3	97.9 $\pm$ 0.8	0.07
	Evening	98.1 $\pm$ 1.1	97.8 $\pm$ 0.7	0.09

DISCUSSION

Various advantages of KMC have been reported in newborns. These include better weight gain, thermoregulation, physiological stability, and less episodes of different diseases such as sepsis, hypothermia, apnea. It has also been associated with decreased mortality rates ¹⁴⁻¹⁷. The previous literature explains different aspects of mother and infant health, and shed light on the capability of various care programs. Our study reported that the mean age of mothers was 28.5 years. The difference in mean ages between the two care groups was not statistically significant ($p>0.05$). This explains that age of mothers was evenly distributed between two groups.

In our study, mean gestational age was 32.5 weeks, with no significant differences between two groups. However, mean hospital stay was significantly different between two groups ($p = 0.02$). Mean hospital stay was longer in CC group (16.1 days) compared to KMC group (10.8 days). A meta-analysis conducted by Narciso et al. revealed that there was a statistically significant reduction in the duration of hospital stay in the KMC group compared to CC group (Mean Difference -1.75, 95% CI -3.22 to -0.28) ¹⁷. Jamil et al. documented that mean duration of hospital stay was 17.5 ± 2.9 days in KMC Group and 20.7 ± 3.4 days among controls ($p<0.0001$) ¹⁸. These results were comparable with our findings.

Our study investigated weight gain patterns in infants over five days. The results demonstrated a consistent upward trend in weight gain across all days, with significant differences favoring the KMC group ($p<0.01$). Infants in the KMC group exhibited higher mean weight gains compared to those in the CC group. These findings align with prior studies. Jamil et al. revealed that mean body weight increased in KMC Group compared to control at day-4, day-6 and day7 ($p<0.0001$). Total weight gain from day-0 to day-7 was found to be 0.24 ± 0.1 kg in KMC groups and 0.15 ± 0.1 kg among controls ($p<0.0001$) ¹⁸. Akhtar et al. reported an average weight gain of 16.6 ± 4.2 g in KMC neonates ¹⁶. Ahmad et al. also reported a higher weight gain at the 2 weeks follow-up in KMC group (1839.87 ± 233.48 g) compared to the CC group (1717.67 ± 207.83 g) with a p-value of 0.036 ¹⁵. Rehman et al. and Shirazi et al. also reported comparable results with a p-values of 0.0001 and 0.006, respectively ^{14, 19}.

Apnea presence revealed significant differences between the two groups during all five days ($p<0.05$). KMC group consistently showed lower percentages of apnea compared to the CC group. It suggested that KMC help reduce respiratory complications in infants and contribute to better respiratory health outcomes. Monitoring body temperature dynamics provided insights into the effects of both care regimes. Although significant differences were observed in morning temperatures on Days 1 and 3, no significant differences were found in evening temperatures. These findings highlight the importance of continuous temperature monitoring in neonatal care to make sure the early detection and management of any

temperature deviations. In a study by Ahmed et al., hypothermia (Group-Standard Method Care 4% vs. Group-KMC 24%) and hyperthermia (Group-Standard Method Care 8% vs. Group-KMC 32%) were significantly low in KMC group²⁰. In a Nepali study, KMC was found to reduce the occurrence of hypothermia (3.1% VS 12.6%, $P = 0.048$)²¹. These findings were consistent with our own data analysis.

Conclusion

Our study confirms the importance of KMC as an effective intervention in improving neonatal weight gain. It is beneficial in protecting neonates against hypothermia. These findings are helpful for clinicians and policymakers to optimize care strategies and improve maternal and infant health outcomes. Further research is necessary to explore the long-term effects of different care regimens on maternal and infant health.

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