

EFFECT OF KANGAROO MOTHER CARE ON WEIGHT GAIN IN PRETERM LOW BIRTH WEIGHT NEONATES: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Preterm low birth weight (LBW) neonates are at increased risk of poor postnatal growth, morbidity, and mortality. Kangaroo Mother Care (KMC), which involves prolonged skin-to-skin contact and exclusive breastfeeding, has been recommended as an effective intervention to improve neonatal outcomes. This study aimed to evaluate the effect of KMC on weight gain in preterm LBW neonates. **Materials and Methods:** This prospective observational study was conducted in the Neonatal Intensive Care Unit of Silchar Medical College and Hospital over a period of one year. Fifty preterm neonates with birth weight between 1.0 kg and 2.0 kg and gestational age less than 37 weeks receiving KMC were included. Neonates were monitored until discharge and followed until 40 weeks postmenstrual age. Primary outcome was daily weight gain. Secondary outcomes included length gain, head circumference gain, duration of KMC, age of regaining birth weight, and complications. Data were analyzed using SPSS version 25. Numerical variables were expressed as mean \pm standard deviation. **Result:** The mean birth weight of neonates was 1.68 ± 0.19 kg and mean gestational age was 33.12 ± 1.28 weeks. The average duration of KMC was 9.26 ± 3.37 hours per day. The mean weight gain observed was 20.65 ± 2.7 g/day. Mean length gain was 0.82 ± 0.11 cm/week and mean head circumference gain was 0.74 ± 0.13 cm/week. Neonates regained birth weight at a mean age of 12.62 ± 4.13 days and were discharged at a mean age of 9.76 ± 4.25 days. Complications were observed in 22% of neonates, with hypothermia being the most common. **Conclusion:** Kangaroo Mother Care is associated with satisfactory weight gain and improved growth parameters in preterm low birth weight neonates. KMC represents an effective, low-cost intervention for improving neonatal growth outcomes in resource-limited settings.

INTRODUCTION

Preterm birth and low birth weight remain major public health concerns worldwide and are among the leading causes of neonatal morbidity and mortality, particularly in developing countries. According to global estimates, approximately 15 million babies are born preterm each year, and a substantial proportion of these neonates have low birth weight. These infants are physiologically immature and face multiple challenges including impaired thermoregulation, feeding difficulties, increased susceptibility to infections, and delayed growth. Among these complications, inadequate postnatal weight gain is one of the most critical concerns, as it

directly influences survival, neurodevelopmental outcomes, and long-term health.^[1,2]

Weight gain in the neonatal period is an important indicator of adequate nutrition, physiological stability, and overall well-being. Preterm low birth weight neonates often experience initial weight loss followed by delayed weight gain due to immature metabolic processes, increased energy expenditure, and feeding intolerance. Failure to achieve optimal weight gain can prolong hospital stay, increase risk of complications, and adversely affect neurodevelopmental outcomes. Therefore, interventions that promote growth and physiological stability are essential in improving outcomes among this vulnerable population.^[3]

Kangaroo Mother Care (KMC), first introduced in Colombia in the late 1970s as an alternative to incubator care in resource-limited settings, has emerged as an effective and evidence-based intervention for the care of preterm and low birth weight infants. KMC involves early, continuous, and prolonged skin-to-skin contact between the mother and infant, exclusive breastfeeding, and early discharge with appropriate follow-up. The skin-to-skin contact provides thermal protection, enhances breastfeeding success, promotes physiological stability, and strengthens maternal-infant bonding.^[4,5]

The physiological benefits of Kangaroo Mother Care are mediated through multiple mechanisms. Skin-to-skin contact helps maintain optimal body temperature, thereby reducing cold stress and conserving energy that would otherwise be expended on thermoregulation. This conserved energy can be utilized for growth and weight gain. KMC also enhances breastfeeding by stimulating maternal milk production and facilitating more frequent and effective feeding, thereby improving nutritional intake. Additionally, KMC stabilizes heart rate, respiratory rate, and oxygen saturation, reduces stress responses, and improves overall metabolic efficiency, all of which contribute to improved growth outcomes.^[6,7]

KMC has also been associated with reduced risk of infections, improved breastfeeding rates, earlier hospital discharge, and enhanced neurodevelopmental outcomes. The World Health Organization recommends KMC as standard care for stable preterm and low birth weight neonates, particularly in resource-limited settings where incubator care may not be readily available or feasible.^[8]

Despite extensive evidence supporting the benefits of Kangaroo Mother Care, observational studies focusing specifically on growth outcomes among neonates receiving KMC under routine clinical conditions provide valuable insight into its effectiveness in real-world settings. Evaluating weight gain and growth parameters in neonates receiving KMC can help strengthen its implementation and support its wider adoption.

This study was conducted to evaluate the effect of Kangaroo Mother Care on weight gain and growth parameters in preterm low birth weight neonates receiving KMC in a tertiary care neonatal unit.

MATERIALS AND METHODS

This prospective observational study was conducted in the Neonatal Intensive Care Unit (NICU) of the Department of Pediatrics at Silchar Medical College and Hospital, a tertiary care teaching hospital located in Silchar, Assam, India. The study was carried out over a period of one year, from July 2018 to June 2019. This NICU provides specialized care to preterm and low birth weight neonates and

serves as a referral center for surrounding districts. The study was conducted after obtaining approval from the institutional ethical committee, and informed consent was obtained from the parents or guardians of all participating neonates.

The study population consisted of preterm low birth weight neonates admitted to the NICU who received Kangaroo Mother Care. Neonates with gestational age less than 37 completed weeks and birth weight between 1.0 kg and 2.0 kg were included in the study. Only clinically stable neonates were enrolled. Neonates with birth weight less than 1 kg, term or post-term neonates, neonates with major congenital anomalies, chromosomal abnormalities, hypoxic ischemic encephalopathy, neonatal sepsis, or those requiring ventilatory or inotropic support were excluded. Neonates whose mothers were critically ill, unable to provide Kangaroo Mother Care, or unwilling to participate were also excluded. These criteria ensured that only stable preterm low birth weight neonates capable of receiving Kangaroo Mother Care safely were included in the study.

A total of 50 eligible neonates receiving Kangaroo Mother Care were included and followed prospectively from enrollment until discharge and up to 40 weeks postmenstrual age. Baseline demographic and clinical details were recorded using a predesigned proforma. Information regarding maternal age, parity, antenatal history, and mode of delivery was collected. Neonatal data including gestational age, birth weight, sex, and anthropometric measurements were also recorded.

Kangaroo Mother Care was initiated as soon as the neonate was clinically stable. Mothers were educated and trained regarding proper KMC technique. The neonate was placed upright in direct skin-to-skin contact against the mother's chest between the breasts. The infant was dressed only in a diaper, cap, and socks, and positioned in a flexed posture with the head turned to one side to ensure airway patency. Mothers were encouraged to provide Kangaroo Mother Care for as long as possible each day, with each session lasting at least one to two hours. The duration of KMC provided each day was recorded in a Kangaroo Mother Care chart maintained by the mother or caregiver.

All neonates were monitored regularly for clinical stability and complications including hypothermia, apnea, hypoglycemia, feeding intolerance, and signs of infection. Standard neonatal care including exclusive breastfeeding, monitoring of vital signs, and supportive care was provided as per NICU protocol.

Anthropometric measurements were performed using standardized methods. Body weight was measured daily using a calibrated electronic weighing scale with an accuracy of ± 5 grams. The weighing scale was calibrated regularly to ensure accuracy. Weight measurements were taken at approximately the same time each day, preferably one hour after feeding, to minimize variation. Length was measured using an infantometer, and

head circumference was measured using a non-stretchable measuring tape. These measurements were performed at enrollment, weekly, at discharge, and during follow-up visits.

The primary outcome measure was weight gain, expressed in grams per day. Secondary outcome measures included length gain, head circumference gain, duration of Kangaroo Mother Care per day, age of regaining birth weight, age at discharge, and occurrence of complications.

Neonates were discharged once they demonstrated consistent weight gain, were feeding adequately, maintaining body temperature without external support, and were clinically stable. After discharge,

neonates were followed up regularly until they reached 40 weeks postmenstrual age, and growth parameters were monitored.

Data were recorded in Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 25. Continuous variables such as weight gain, length gain, and head circumference gain were expressed as mean and standard deviation. Categorical variables such as sex and complications were expressed as frequency and percentage. The analysis focused on describing growth outcomes among neonates receiving Kangaroo Mother Care.

RESULTS

Table 1: Baseline Characteristics of Neonates (n = 50)

Parameter	Mean ± SD	Range
Gestational age (weeks)	33.12 ± 1.28	30 – 36
Birth weight (kg)	1.68 ± 0.19	1.20 – 1.98
Weight at enrollment (kg)	1.64 ± 0.24	1.10 – 1.95
Length at enrollment (cm)	42.25 ± 2.03	38 – 46
Head circumference at enrollment (cm)	30.38 ± 1.57	27 – 33

The mean gestational age of neonates enrolled in the study was 33.12 ± 1.28 weeks, indicating that the majority were moderate preterm neonates. The mean birth weight was 1.68 ± 0.19 kg, consistent with low

birth weight criteria. Anthropometric parameters at enrollment reflected expected growth parameters for preterm low birth weight neonates.

Table 2: Sex Distribution of Neonates

Sex	Frequency	Percentage
Male	24	48%
Female	26	52%
Total	50	100%

Among the study population, 26 neonates (52%) were female and 24 neonates (48%) were male,

showing nearly equal sex distribution with a slight female predominance.

Table 3: Birth Weight Distribution

Birth Weight Category	Frequency	Percentage
<1.5 kg	5	10%
1.5–1.8 kg	30	60%
1.8–2.0 kg	15	30%
Total	50	100%

The majority of neonates (60%) had birth weight between 1.5 and 1.8 kg. Fifteen neonates (30%) had birth weight between 1.8 and 2.0 kg, while only

10% had birth weight less than 1.5 kg. This indicates that most neonates belonged to the moderate low birth weight category.

Table 4: Duration of Kangaroo Mother Care per Day

Duration of KMC	Frequency	Percentage
<4 hours	4	8%
4–7 hours	11	22%
8–12 hours	25	50%
>12 hours	10	20%
Total	50	100%

Half of the neonates (50%) received Kangaroo Mother Care for 8–12 hours per day, while 20% received KMC for more than 12 hours per day. The

mean duration of KMC was 9.26 ± 3.37 hours per day, indicating good compliance with Kangaroo Mother Care practices.

Table 5: Growth Outcomes in Neonates Receiving Kangaroo Mother Care

Growth Parameter	Mean ± SD
Weight gain (g/day)	20.65 ± 2.70
Length gain (cm/week)	0.82 ± 0.11
Head circumference gain (cm/week)	0.74 ± 0.13

The mean weight gain observed among neonates receiving Kangaroo Mother Care was 20.65 ± 2.70 g/day, indicating satisfactory postnatal growth. The

mean length gain was 0.82 ± 0.11 cm/week, and mean head circumference gain was 0.74 ± 0.13 cm/week, reflecting appropriate somatic growth in these neonates.

Table 6: Clinical Outcomes

Clinical Parameter	Mean ± SD
Age of regaining birth weight (days)	12.62 ± 4.13
Age at discharge (days)	9.76 ± 4.25

Neonates regained their birth weight at a mean age of 12.62 ± 4.13 days, which is consistent with expected growth patterns in preterm neonates. The

mean age at discharge was 9.76 ± 4.25 days, indicating relatively early stabilization and recovery.

Table 7: Complications Observed in Neonates Receiving KMC

Complication	Frequency	Percentage
Hypothermia	6	12%
Apnea	2	4%
Hypoglycemia	2	4%
Sepsis	1	2%
No complication	39	78%
Total	50	100%

Complications were observed in 22% of neonates. Hypothermia was the most common complication, occurring in 12% of neonates. Apnea and hypoglycemia were observed in 4% each, while sepsis was observed in 2%. The majority of neonates (78%) did not develop any complications, indicating the safety of Kangaroo Mother Care.

population represents the typical clinical group most likely to benefit from KMC.

The primary outcome of this study was weight gain, and the mean weight gain observed was 20.65 ± 2.70 g/day. This rate of weight gain is consistent with intrauterine growth rates during the third trimester, which range between 15 and 20 g/kg/day.^[2] Achieving weight gain comparable to intrauterine growth is considered an important goal in preterm neonatal care, as it supports optimal organ development and neurodevelopmental outcomes.

The improved weight gain observed in neonates receiving KMC can be explained by several physiological mechanisms. Skin-to-skin contact plays a critical role in maintaining thermal stability, thereby reducing heat loss and preventing hypothermia. Preterm neonates have immature thermoregulatory systems due to reduced brown fat stores, thin skin, and a large surface area-to-body weight ratio. As a result, they are prone to hypothermia, which increases metabolic demands and energy expenditure.^[3] By maintaining thermal neutrality, Kangaroo Mother Care reduces the need for metabolic thermogenesis, allowing energy to be redirected toward growth and tissue synthesis.

In addition to thermal regulation, KMC promotes improved breastfeeding, which directly contributes to enhanced nutritional intake. Skin-to-skin contact stimulates maternal oxytocin release, which enhances milk production and facilitates milk ejection reflex.^[4] Improved breastfeeding frequency and effectiveness ensure adequate caloric intake, which is essential for weight gain. Conde-Agudelo and Díaz-Rossello, in a systematic review and meta-

DISCUSSION

This prospective observational study evaluated the effect of Kangaroo Mother Care (KMC) on weight gain and growth outcomes in preterm low birth weight neonates. The findings demonstrated that neonates receiving KMC achieved satisfactory weight gain, appropriate increases in length and head circumference, early regaining of birth weight, and a low incidence of complications. These findings support the effectiveness of Kangaroo Mother Care as a physiologically beneficial and safe intervention for promoting growth in preterm low birth weight neonates.

In the present study, the mean gestational age of neonates was 33.12 ± 1.28 weeks, and the mean birth weight was 1.68 ± 0.19 kg. These findings are consistent with the typical demographic profile of moderate preterm low birth weight neonates. Similar gestational age and birth weight profiles have been reported in previous KMC studies. Charpak et al. reported a mean gestational age of approximately 32–34 weeks and mean birth weight between 1.5 and 1.8 kg among neonates receiving Kangaroo Mother Care, comparable to the present study population.^[1] This indicates that the study

analysis, reported that neonates receiving KMC showed improved breastfeeding rates and higher weight gain compared to conventional care.^[5]

Another important physiological benefit of Kangaroo Mother Care is the stabilization of vital parameters. Skin-to-skin contact has been shown to stabilize heart rate, respiratory rate, and oxygen saturation. Ludington-Hoe et al. demonstrated that neonates receiving KMC exhibited improved cardiorespiratory stability and reduced episodes of apnea and desaturation.^[6] Improved physiological stability reduces energy expenditure associated with stress responses and contributes to better growth outcomes.

In the present study, neonates regained their birth weight at a mean age of 12.62 ± 4.13 days. This finding is consistent with previous studies that have reported earlier regaining of birth weight in neonates receiving Kangaroo Mother Care. Normally, preterm neonates lose 10–15% of birth weight in the first few days of life due to fluid shifts and metabolic adaptation, and regaining birth weight typically occurs within 10–14 days.^[7] Early regaining of birth weight reflects adequate nutritional intake and improved metabolic efficiency, both of which are facilitated by Kangaroo Mother Care.

The present study also demonstrated appropriate gains in length and head circumference, with mean length gain of 0.82 ± 0.11 cm/week and mean head circumference gain of 0.74 ± 0.13 cm/week. These findings are consistent with normal growth patterns in preterm neonates and indicate that Kangaroo Mother Care supports overall somatic and neurological growth. Head circumference growth is particularly important as it reflects brain growth and neurodevelopment. Adequate head growth is associated with improved cognitive outcomes in later childhood.^[8]

The mean duration of Kangaroo Mother Care in this study was 9.26 ± 3.37 hours per day. Previous studies have demonstrated that longer duration of KMC is associated with improved growth outcomes. WHO guidelines recommend prolonged and continuous Kangaroo Mother Care whenever possible, as longer duration enhances physiological stability and promotes growth.^[9] Prolonged skin-to-skin contact improves thermal regulation, enhances feeding success, and reduces stress responses, all of which contribute to improved weight gain.

The incidence of complications in the present study was relatively low, with complications observed in 22% of neonates. Hypothermia was the most common complication, occurring in 12% of neonates. The low complication rate observed in this study is consistent with previous reports demonstrating that Kangaroo Mother Care is safe and effective. Boundy et al., in a meta-analysis involving over 15,000 neonates, reported that Kangaroo Mother Care significantly reduced neonatal morbidity and mortality, including hypothermia and infection.^[10]

The mean age at discharge in the present study was 9.76 ± 4.25 days, indicating relatively early stabilization and recovery. Kangaroo Mother Care has been associated with earlier hospital discharge due to improved physiological stability, improved feeding, and enhanced growth. Early discharge reduces healthcare costs, decreases hospital overcrowding, and promotes maternal bonding and confidence in neonatal care.^[11]

The beneficial effects of Kangaroo Mother Care on growth can also be attributed to its effect on reducing stress in neonates. Skin-to-skin contact reduces cortisol levels and promotes parasympathetic activity, which enhances digestion, nutrient absorption, and growth.^[12] Reduced stress responses improve metabolic efficiency and support optimal weight gain.

Furthermore, Kangaroo Mother Care promotes maternal-infant bonding, which enhances maternal responsiveness and caregiving behavior. Improved maternal involvement leads to better feeding practices and improved neonatal care, which indirectly contributes to improved growth outcomes.^[13]

The findings of this study are consistent with global evidence supporting Kangaroo Mother Care as an effective intervention for promoting growth in preterm low birth weight neonates. KMC is particularly valuable in resource-limited settings where access to advanced neonatal care technologies may be limited.

CONCLUSION

Overall, the findings of this study demonstrate that Kangaroo Mother Care is associated with satisfactory weight gain, appropriate growth, and low complication rates in preterm low birth weight neonates. These results reinforce the importance of Kangaroo Mother Care as a simple, safe, cost-effective, and physiologically beneficial intervention that should be widely implemented in neonatal care settings.

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