A study to determine the effectiveness of Kangaroo Mother Care (KMC) on Physiological Parameters of Low Birth Weight (LBW) infants admitted at National Medical College, Birgunj

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ABSTRACT

INTRODUCTION

Low birth weight (LBW) infants are the high risk conditions with the association of hypothermia, respiratory instability, bradycardia or tachycardia, poor weight gain which directly relates with the low health status. Kangaroo Mother Care (KMC) care is the skin to skin contact between mother and child promoting attachment, bonding breastfeeding which is cost-effective, accessible and non-invasive method benefiting the regulation of physiological parameters in infants. This study aimed to determine the effectiveness of KMC on stabilizing major physiological parameters of LBW infants admitted at National Medical College, Birgunj.

MATERIAL AND METHODS

A descriptive pre–post interventional study was conducted on 150 medically stable LBW infants eligible for KMC. Infants received 1–2 hours of KMC per session in a designated mother-infant KMC corner under trained supervision. Physiological parameters including temperature, heart rate, respiratory rate, oxygen saturation, and weight were recorded immediately before and after KMC. Data were analyzed descriptively to determine the proportion of infants showing improvement, no change, or deterioration in each parameter.

RESULTS

KMC led to substantial improvement across all physiological parameters. Improve in temperature was seen in 88% of infants, heart rate in 82%, respiratory rate in 78%, oxygen saturation in 94%, and weight in 100% infants. No deterioration was observed in any parameters. The intervention promoted thermoregulation, cardio-respiratory stability, and weight gain, highlighting the holistic benefits of KMC for LBW infants.

CONCLUSION

Kangaroo Mother Care is a safe, effective, and feasible method for improving physiological stability in LBW infants. Its routine implementation in neonatal care can enhance growth, reduce morbidity, and support optimal neonatal outcomes, particularly in resource-limited settings.

KEYWORDS

Kangaroo mother care, Low birth weight, Neonates, Physiological parameters, Skin-to-skin contact, Weight gain

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INTRODUCTION

Low birth weight (LBW) has been defined by WHO as weight at birth of < 2500 grams. Birth weight of the infants is measured within the first hour of life, and the weight of 2500 gm- 4000 gm is considered to be the normal weight regardless of the gestational weight, so, the baby born with less than 2500 gm is considered to be the low birth weight (LBW) infants. LBW is mostly associated with the preterm babies. It is estimated that globally, out of 139 million live births, more than 20 million LBW babies are born each year-over 95% of them in developing countries.[1] It is also estimated that, in developing countries, LBW infants are approximately 13 times more likely to die than normal birth weight counterparts.[2]

Such babies are mostly in high risk cases as the normal physical parameters of such babies are deviated and they are not able to regulate the vital signs properly. LBW infants shows clinical features like, hypothermia, breathing problem, poor muscle tone, poor nutrition, lack of immunity and also desaturations of the oxygen. These physical symptoms are needed to be taken care of in the initial days of the newborn as the complications may even be fatal if not managed in time.

Kangaroo mother care (KMC) implies placing the newborn baby in intimate skin-to-skin contact with the mother's chest and abdomen coupled with frequent and preferably exclusive breast-feeding.[3] Kangaroo mother care is indicated to low birth weight infants and preterm babies, as their disrupted physiological parameters are restored with the help of KMC. It is the method of providing warmth, attachment and bonding between the mother and the baby by keeping the baby between the breasts of the mother in a proper position with the promotion of breastfeeding. It is a nonconventional, cost-effective method which makes it accessible, feasible and more significant way initiated by WHO. With such a good benefits that can make LBW infants healthy in the conventional way, this method is still underutilized in various neonatal units. This study evaluates the effectiveness of KMC on physiological parameters of LBW infants.

MATERIAL AND METHODS

This study followed a descriptive pre–post interventional design to determine the effectiveness of kangaroo mother care (KMC) on stabilizing selected physiological parameters of low birth weight (LBW) infants. The study compared infants' temperature, heart rate, respiratory rate, oxygen saturation, and weight before and after receiving KMC to evaluate physiological improvement.The research was conducted in the neonatal intensive care unit (NICU) and postnatal ward of National Medical College and Teaching Hospital, Birgunj, Nepal. KMC was performed in a designated mother-infant KMC corner under the supervision of trained nursing staffs. The study was carried out over a period of one year (1st May 2024 to 30th April 2025), during which data collection and direct observation of infants receiving KMC were conducted.

Ethical clearance for the study was obtained from the Institutional Ethics Committee of National Medical College, Birgunj, Nepal (Ref. F-NMC/781/080-081). Written and informed consent was obtained from mothers prior to data collection. Confidentiality and anonymity of all participants were strictly maintained.

A total of 150 LBW infants admitted to the NICU and fulfilling the KMC eligibility criteria were included in the study. Infants fulfilling the inclusion criteria (those infants with birth weight <2500 grams, infants who were medically stable and eligible for KMC as per the hospital protocol and parents/guardians providing consent for participation) were included in the study. Infants requiring ventilatory support or continuous oxygen therapy, infants with congenital anomalies or severe infections and critically ill neonates for whom KMC was clinically contraindicated were not included in the present study.

KMC Procedure: KMC was provided according to the WHO guidelines. Each infant received a minimum of 1–2 hours of uninterrupted KMC per session, positioned upright between the mother's breasts with skin-to-skin contact and covered with a warm blanket. Vital signs were recorded immediately before and after the KMC session. Variables measured were temperature (°C), heart rate (beats/min), respiratory rate (breaths/min), oxygen saturation (SPO2 %) and weight (kg). These parameters were selected as they directly reflect neonatal physiological stability and responsiveness to KMC.

Main outcomes and methods: The main outcomes focused on the proportion of infants showing improvement, no change, or deterioration in each parameter after KMC.

- Temperature improvement was defined as movement toward the normal neonatal range (36.5–37.5°C).
- Heart rate improvement was defined as stabilization within 120–160 bpm and correction of bradycardia.
- Respiratory improvement included normalization (30–60 breaths/min) and reduction in apnea or tachypnea.
- SPO2 improvement was defined as movement toward ≥ 95%.
- Weight improvement referred to any measurable increase after repeated KMC sessions.

Data comparison was done by categorizing infants based on increase–decrease patterns, allowing a clear descriptive evaluation of the physiological effect of KMC.

Definitions used in the study

a) **Hypothermia:** It is the condition where the body temperature is less than the normal value i.e. (36.5–37.5°C) that has adverse effects in health as it disrupts the thermal regulation of the body.

b) **Bradycardia:** It is the phenomena of decrease in the heart rate less than 120 bpm in infants which leads to cardiac instability.
c) **Tachycardia:** It is the increase of the heart rate of the infants i.e. more than 160bpm.
d) **Tachypnea:** It is the condition of increase in breathing patterns in infant which is more than 60 breaths/min.
e) **Bradypnea:** It is the phenomena characterized by the decrease in respiratory rate of the infants less than 30 breaths/min that leads to respiratory distress.
f) **Destauration:** It is defined as the decreased oxygen saturation in the body less than the required oxygen i.e. <95%.

Data were entered and analyzed using Microsoft Excel 2010. Descriptive statistics such as frequency and percentage were used to present the change patterns (improved, no change, worsened). Results were displayed through tables and a line graph summarizing the overall physiological response to KMC. No inferential statistical tests were applied.

RESULTS

The total of 150 cases of LBW infants were studied and they clearly show the significant change in the physiological parameters including temperature, respiration, heart rate, respiratory rate, oxygen saturation and their body weight. All infants received at least one structured KMC session lasting 1-2 hours. No adverse events were reported, and no infants were excluded during post-observation. Physiological parameters were recorded immediately before and after KMC to determine the stabilizing effect of the intervention.
The thermal regulation in the infants was observed with the significant difference. Before KMC, 21 (14%) infants had moderate hypothermia (32–35°C), 67 (44.7%) had mild hypothermia (35–36.4°C), and only 62 (41.3%) were within the normal neonatal range (36.5–37.5°C). After KMC, the number of infants achieving normal temperature increased substantially to 130 (86.7%).

Table 1. Change in Body temperature before and after KMC (N = 150)

Temperature Status	Before KMC (n)	After KMC (n)	Change Pattern
Severe hypothermia (<32°C)	0	0	None
Moderate hypothermia (32–35°C)	21	2	19 improved
Mild hypothermia (35–36.4°C)	67	18	49 improved
Normal temperature (36.5–37.5°C)	62	130	Significant improvement
Hyperthermia (>37.5°C)	0	0	None

A total of 132 infants (88%) demonstrated measurable improvement in temperature status, whereas 18 (12%) showed no significant change. Importantly, none of the infants experienced temperature deterioration. These findings highlight the strong effectiveness of KMC in correcting hypothermia and promoting stable thermoregulation among low birth weight (LBW) infants.

Prior to KMC, abnormalities in cardiac rate regulation were evident among the infants. Sixteen infants (10.7%) exhibited bradycardia (<100 bpm), and 41 (27.3%) were in the low-normal range (100–119 bpm), indicating suboptimal cardiac status. Only 83 infants (55.3%) were within the normal neonatal heart rate range of 120–160 bpm. After KMC was provided, the number of infants within the normal physiological range increased markedly to 132 (88%).

Table 2. Change in heart rate before and after KMC (N = 150)

Heart Rate Status	Before KMC (n)	After KMC (n)	Change Pattern
Bradycardia (<100 bpm)	16	0	All corrected
Low-normal (100–119 bpm)	41	12	29 improved
Normal (120–160 bpm)	83	132	49 improved
Tachycardia (>160 bpm)	10	6	4 improved

About 124 infants (82.7%) showed improvement in heart rate, while 26 (17.3%) displayed no change, and none exhibited worsening. These findings illustrate the substantial stabilizing effect of KMC on cardiac functioning, particularly in correcting bradycardia and enhancing autonomic regulation.

Before KMC, respiratory irregularities were present, with 14 infants (9.3%) showing bradypnea (<30 breaths/min) and 35 (23.3%) exhibiting tachypnea (>60 breaths/min). Although the majority (n=101, 67.3%) were within the normal respiratory rate range (30-60 breaths/min), deviations were clinically significant. After KMC, respiratory stability improved notably, with 133 infants (88.7%) falling within the normal range.

Table 3. Change in respiratory rate before and after KMC (N = 150)

Respiratory status	Before KMC (n)	After KMC (n)	Change pattern
Bradypnea (<30/min)	14	4	Improved in 10
Normal (30–60/min)	101	133	32 improved
Tachypnea (>60/min)	35	13	22 improved

A total of 118 infants (78.7%) demonstrated improvement in respiratory rate, whereas 32 (21.3%) showed no change, and none worsened. These results reflect the supportive role of KMC in facilitating respiratory rhythm stabilization and reducing both bradypneic and tachypneic episodes.

At baseline, oxygenation levels indicated substantial respiratory compromise among several infants. Seven infants (4.7%) experienced severe desaturation (<85%), and 94 (62.7%) had mild desaturation (85–94%). Only 49 infants (32.6%) maintained normal oxygen saturation levels (≥95%). Following KMC, there was a pronounced improvement, with 114 infants (76%) achieving normal SPO_2 levels.

Table 4. Change in oxygen saturation before and after KMC (N = 150)

Oxygen saturation status	Before KMC (n)	After KMC (n)	Change pattern
Severe desaturation (<85%)	7	0	All improved
Mild desaturation (85–94%)	94	36	58 improved
Normal (≥95%)	49	114	65 improved

A striking 142 infants (94.7%) demonstrated improved oxygen saturation, while only 8 (5.3%) showed no change, and none exhibited deterioration. This substantial enhancement emphasizes the efficacy of KMC in improving oxygenation and supporting cardio-respiratory regulation in LBW infants.

Although weight was monitored as a short-term outcome across repeated KMC sessions, positive trends were observed. Initially, only 31 infants (20.7%) weighed above 2.0 kg. After consistent exposure to KMC, this number increased to 56 infants (37.3%). All 150 infants (100%) demonstrated measurable weight gain, reflecting improved physiological stability, enhanced thermal control, and increased feeding efficiency. This universal improvement reinforces the long-recognized role of KMC in promoting optimal growth among LBW infants.

Table 5. Change in weight before and after KMC (N = 150)

Weight status	Before KMC (n)	After KMC (n)	Change pattern
<1.5 kg (VLBW)	31	16	15 improved
1.5–1.8 kg	47	38	9 improved
1.8–2.0 kg	41	40	Stable
>2.0 kg	31	56	25 improved

A consolidated summary of changes across all physiological parameters is presented in table 6. KMC produced improvement in each domain without any instance of deterioration. Temperature improved in 132 (88%) infants, heart rate in 124 (82%), respiratory rate in 118 (78%), oxygen saturation in 142 (94%), and weight in all 150 infants. This consistent pattern across multiple physiological systems underscores the comprehensive stabilizing benefits of KMC in the care of LBW infants.

Summary of increase-decrease pattern (N = 150)

Parameter	Improved (↑)	No Change	Worsened (↓)	Improved (%)
Temperature	132	18	0	88%
Heart Rate	124	26	0	82%
Respiratory rate	118	32	0	78%
Oxygen saturation	142	8	0	94%
weight	150	0	0	100%

Weight showed universal improvement, with all 150 infants (100%) gaining weight during the study period and no infants showing stability or decline.

These findings collectively indicate that KMC was highly effective across all physiological domains, with improvement rates ranging from 78% to 100%, and with no deterioration observed in any parameter, underscoring its robust stabilizing effect on low birth weight infants.

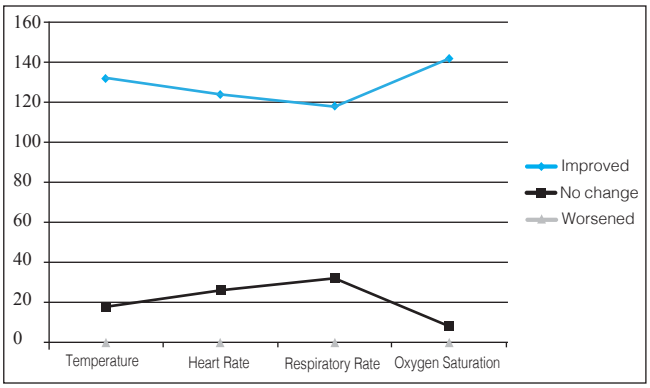

Figure 1. Summary of change patterns after KMC (N= 150)

A line graph was generated to visually summarize the improvement patterns across all physiological parameters. The graph shows a clear upward trend in improvement for all five variables, with SPO_2 and weight showing the highest levels of improvement, followed by temperature, heart rate, and respiratory rate.

DISCUSSION

The findings concluded that KMC is a highly effective method being cost effective, non-invasive and accessible way with the significant stabilization of the major physiological parameters with more than 80% of infants experiencing the improved thermal, breathing, heart rate, oxygen saturation regulation. This aligns with the previous research indicating that skin to skin contact promotes warm through direct maternal body heat, reducing risk of hypothermia.[3] Our study stated the weight of the infants was completely stabilized with 100% results which directly related with the improved immunity of the infants preventing the risk of infection. A RCT study stated KMC improves growth in low birth weight infants and has a significant role in protecting the LBW infant from hypothermia, hypoglycemia and sepsis.[4] The weight gain is associated with the role of KMC in increased nutritional intake, metabolic stability and growth with the promotion of breastfeeding that is an important factor of KMC.Consistent skin-to-skin contact encourages frequent breastfeeding and energy conservation, which accelerates weight gain and overall physiological development. Comparable findings have been reported in both low- and high-resource settings, highlighting the generalizability of KMC's benefits.[5]

The prior study indicating that KMC enhances autonomic regulation reduces the episodes of bradycardia and tachycardia aligns with our findings of regulated heart rates

in 82.7% of infants.[6] The cardiac stability is one the significant parameter benefited by the KMC care in our research which is also supported by the prior research as stated. Along with the heart rates, breathing patterns, oxygen saturates is also stabilized to normal in 80-90% of the infants with the KMC care as it provides overall benefits in the infant health status. These findings suggest that KMC supports cardio-respiratory stability, likely through reduction of stress and improved autonomic balance.[3] The maternal contact, attachment and bonding has such direct advantages that is clearly prevalent in our along with some prior studies.

Emphasis of the KMC care with the guidelines of WHO is beneficial along with no any adverse effects as it being non-invasive, simple yet effective method. It is a safe, cost-effective, feasible to each and every maternal and child care in all the settings, where specialized medical equipments including incubators and advanced neonatal care may not be accessible. These outcomes are consistent with global recommendations advocating KMC as a standard care practice for medically stable LBW infants, particularly in developing countries such as Nepal.[7]

The main limitation of the study was that it was limited to a single tertiary care center, which may affect the generalizability of the findings. The study employed a descriptive pre-post design without a control group, and no inferential statistics were applied. Long-term outcomes of KMC, such as developmental milestones or extended growth patterns, were not assessed. Additionally, data collection relied on short-term observation of physiological parameters immediately before and after KMC sessions.

CONCLUSION

KMC is highly effective in improving physiological stability among low birth weight infants. The intervention significantly enhanced temperature regulation, heart rate, respiratory rate, oxygen saturation, and weight gain, with no observed deterioration. KMC is a safe, cost-effective, and feasible method that supports holistic neonatal care, promotes growth, and can be readily implemented in both resource-limited and advanced healthcare settings.

CONFLICT OF INTEREST

None

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