ORIGINAL ARTICLE

Effect of Continuous versus Intermittent Kangaroo Mother Care on Weight Gain and Duration of Hospital Stay among Low-Birth-Weight Admitted at a Level II NICU: A Randomized Control Trial

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ABSTRACT

Background. The Neonatal Intensive Care Unit (NICU) admission at the Philippine General Hospital (PGH) exceeds total bed capacity. Decreasing admissions to the NICU would prevent overcrowding of patients, improve patient care, reduce hospital stay, and reduce predisposition to hospital-acquired infections.

Objective. To determine the effect of continuous versus intermittent Kangaroo Mother Care (KMC) on weight gain and duration of hospital stay among low birth weight (LBW) neonates weighing 1,800 - 2,220 grams.

Methods. Forty-six (46) stable LBW were randomized to either continuous (≥12 hours in the maternity ward) or intermittent (≤6 hours in the NICU step-down unit) KMC groups. Daily weight and weekly length, head and chest circumference until discharge, and duration of hospital stay were measured. Data were analyzed using the Mann-Whitney U-test and Fisher's exact test.

Results. Infants in continuous KMC had an average weight gain of 50 grams/day (p=0.509) and had an average duration of hospital stay of 3 days (p=0.218). Results were not statistically different from intermittent KMC.

Conclusion. There was no evidence to show that weight gain and duration of hospital stay among infants in continuous KMC were significantly different from those in the intermittent KMC group.

Key Words: Kangaroo Mother Care, Continuous, Intermittent, Low Birth Weight

INTRODUCTION

In 20.5 million newborns born globally in 2015, an estimate of 14.6 percent of all babies suffered from low birth weight. Of the 20.5 million low birthweight babies born, nearly half were born in South Asia. The World Health Organization (WHO) defines low birth weight (LBW) as less than 2,500 grams and very low as less than 1,500 grams at birth.[1]

Although LBW and prematurity are not direct causes of death, complications resulting from them account for 24% of neonatal deaths. LBW is a significant cause of perinatal, neonatal, and postnatal mortality and morbidity, where early morbidity may produce adverse outcomes in subsequent life.[2] LBW survivors demonstrate significant growth retardation as reflected by lower body weights, heights, and head circumferences compared to normal-weight peers.[3]

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There is a significant variation in LBW incidence across the main geographic regions, ranging from 6% to 18%. The highest incidence of low birth weight occurs in the subregion of South-Central Asia, where 27% of infants are LBW.

For other subregions within Asia, the incidence is much lower, although there is considerable variation. More than half of the 49 countries, Asian countries, and territories have LBW rates below 10, while seven countries have levels above 20%. The incidence in South-Eastern Asia is at 11.6%, whereas the Philippines has 20%, having 396 LBW infants per 1,000 live births.[4]

Many of the almost five million neonatal deaths occurring annually in low-income countries could be prevented by appropriate, good quality care of LBW infants. The technologies currently used in rich countries are unavailable in most low-income countries. Inadequate health care is another factor. The health system's capacity to respond to the needs of mothers and newborns is substandard and unevenly distributed throughout the Philippines. Access to care can be a significant constraint, particularly for poor and marginalized groups – the ones whose burden of ill health is the highest. In the United States, the mean cost of hospitalization for preterm/LBW infant stay was $15,100, compared with $600 for an uncomplicated newborn and $2,300 for all other infant hospitalizations. The mean length of stay for preterm/LBW, uncomplicated, and all other infants were 12.9, 1.9, and 3.0 days, respectively.[3] However, in low-income countries, such as the Philippines, the cost of preventing LBW is high. This challenge is more significant due to the increased prevalence of preterm birth rates and fewer available resources. Preventive programs, though very desirable, can be effective only on a medium and long-term basis, and prevention involves many non-health interventions.[2]

In most developing countries, only a small proportion of LBW infants can be hospitalized for care. Many deliveries still take place at home in these settings, and even if born in facilities, newborns are discharged early.[5] The key features of Kangaroo Mother Care (KMC) are early, continuous, and prolonged skin-to-skin contact between the mother and baby, accomplished by the baby being firmly attached to the mother's chest both day and night, allowing frequent and exclusive breastfeeding. KMC is initiated in the hospital. It can be continued at home, allowing tiny babies, regardless of weight or gestational age, to be discharged early, provided adequate support and follow-up are arranged.[1] KMC is a humanization of medical technology and is a rational tool to maximize available human and technical resources. KMC has three distinct uses: (1) it can be applied in places without appropriate neonatal care facilities as it is the only alternative to the lack of incubators; (2) in places with access to all levels of neonatal care, KMC offers early mother-infant, skin-to-skin contact, enhancing the quality of mother-infant bonding and successful breastfeeding, and (3) in situations where facilities are of a good standard, but insufficient to cope with the demands, KMC is an alternative to minimal care after the infant has overcome extrauterine life adaptation problems.[6]

The original KMC method with ideally 24 hours/day of mother-infant skin-to-skin care, namely continuous KMC, was intended as an alternative to conventional care in incubators in low-income settings.[7] As in many other Neonatal Intensive Care Units (NICUs) in affluent settings, NICU KMC is implemented as limited sessions with mother-infant skin-to-skin care in kangaroo position, for 1 to 3 hours, occurring over a limited period, namely intermittent kangaroo mother care (I-KMC).[8] KMC can be provided intermittently and continuously.

Where continuous KMC is not possible, WHO recommends intermittent KMC over conventional care for stable newborns weighing 2000 grams or less at birth.[9] Intermittent KMC refers to recurrent but not continuous skin-to-skin contact between a mother and infant alternated with conventional care. Evidence around intermittent KMC and mortality is inconclusive; however, there is evidence that intermittent KMC reduces the risk of hypothermia, severe infection, and nosocomial infection.[10] A randomized control trial (RCT) in India suggested that early intermittent KMC increased exclusive breast milk feeding and direct breastfeeding in LBW infants.[11]

The Philippine General Hospital (PGH) caters mainly to high-risk deliveries, which are premature and with LBW. It has been a perennial problem that admissions at the PGH-NICU exceed patient capacity. Since most of the admissions are complicated, prolonged stays of some patients are inevitable. This compromises patient care and predisposes patients to acquire hospital infections and their complications. It is hoped that neonates, weighing ≥ 1,800 and ≤ 2,200 grams, can directly be roomed-in with their mothers and not add up to the admissions at the NICU and further prolong their hospitalization. This study aimed to determine the effect of continuous KMC on weight gain and duration of hospital stay among low-birth-weight neonates weighing ≥ 1,800 and ≤ 2,200 grams admitted at Ward 15 Maternity Ward compared to intermittent KMC at NICU Level II.

Review of Literature

KMC was explicitly developed for LBW, preterm infants, or both. It is a method of care in which infants are carried continuously in a skin-to-skin position with the mother to prevent hypothermia, promote exclusive breastfeeding, and strengthen the mother-infant bond.[12] Babies weighing 2000 g or less at birth and unable to regulate their body temperature remain with their mothers as incubators, their primary source of warmth, stimulation, and nourishment. If a neonatal care unit is available but overwhelmed by demand, KMC rationalizes resources by freeing up incubators for sicker infants. It is initiated in the hospital and continued at home, thereby decreasing the length of stay of these patients at the NICU. It is an alternative to the expensive and seldom available traditional care method for LBW infants.[6]

A study by Cattaneo et al. stated that all neonates, irrespective of birth weight, gestational age, and place of birth, should have skin-to-skin contact with their mothers immediately after birth. As soon as possible, after the drying and assessing procedure, all neonates should be given to the mother for skin-to-skin contact for at least 2 hours to stabilize their body temperature and initiate bonding. Breastfeeding should start as soon as possible, within 60 minutes of birth.[13]

A RCT by Shuko et al. in 2010, which compared earlier versus later continuous KMC for stable LBW infants, stated that earlier KMC showed better physiological stabilization at 6 hours of birth. The intervention group (earlier KMC) began KMC as soon as possible within 24 hours post-birth. The control group (later KMC) initially followed conventional care and began KMC when infant and mother/families were completely settled and ready, approximately 48-72 hours post-birth. Adapting to continuous KMC earlier appears to reduce weight loss in the early days after birth. However, bodyweight changes from birth to day 14 to 28 were not different in early KMC infants compared with later KMC infants. The mean duration of hospitalization was shorter in the earlier than in the latter KMC group. In the earlier KMC group, more cases were discharged within seven days than in the later KMC group.[14]

Charpark et al. in 1997, conducted a study comparing KMC versus traditional care for newborn infants ≤ 2000 grams that provided the following findings: 1) It confirmed that KMC was not associated with an additional risk of dying, compared with the traditional care infants by 40 to 41 weeks of conception (WCA); 2) Early discharge under KMC did not increase readmission attributable to metabolic and noninfectious respiratory complications of LBW infants such as primary apnea, hypoglycemia, and bronchoaspiration; 3) KMC reduced the number of total days in the hospital and diminished the overcrowding of the neonatal unit, which was a particular problem in developing countries. The reduction in hospital days was more marked for newborns with lower birth weights and nonexistent for those ≥ 1800 g. This was attributable to the fact that in the study institution, traditional care implied discharge when the infant's weight was 1700 to 1800 g. In other places where infants were discharged at higher weights, the in-hospital saving stay extended to infants of 1800 g. The study provided evidence showing that when using KMC (including early discharge) as an alternative to a Minimal Care Unit (MCU) in hospitals with good technology but limited resources, kangaroo infants did better when reaching term (40 to 41 WGA) than babies under the usual care. The evidence showed that 1) mortality and growth indices were similar; 2) total episodes of infection were similar, but the spectrum of severity differed, favoring kangaroo infants; 3) there was an average 1.1-day-saving in-hospital stay for kangaroo infants, and savings were more significant in lower birth weight infants; 4) there was a small but significant difference in early breastfeeding patterns.[15]

Evidence backs the effectiveness and safety of KMC in stable, preterm infants. In LBW infants weighing ≤ 2000 g who could not regulate their temperature, KMC was as safe and effective as traditional care with incubators. An open RCT in Bogotá, Colombia, assessed the long-term clinical effects of KMC by randomizing 746 LBW infants. Follow-up at the 12 months of age corrected for gestational age (93% of children) found that KMC had improved successful breastfeeding rates and infections were milder in those children. Hospital stays were reduced in "Kangaroo" newborns weighing ≤ 1500 g. A non-significant reduction in mortality (3.1% *vs.* 5.5%; relative risk 0.57, 95% confidence interval 0.17 to 1.18) and slight improvements in developmental indices were found with KMC. The investigators found no significant differences in physical growth patterns or in the rates of cerebral palsy, failure to thrive, visual problems, deafness, or hip dysplasia. Blind assessments of bonding between mother and infant using videos in a subsample of 488 mother-infant dyads found that bonding improved markedly with KMC, as did neurodevelopmental evaluations in infants at higher risk.[16] KMC delivered ideal conditions for stable, LBW infants to thrive, strengthened parental participation and empowerment, and contributed to the healing process.

OBJECTIVES

General Objective

To determine the effect of continuous versus intermittent KMC on the weight gain and duration of hospital stay of LBW neonates weighing ≥ 1,800 grams and ≤ 2,200 grams.

Specific Objective

a. To compare the rate of weight gain between LBW infants on continuous KMC versus those in intermittent KMC.
b. To compare the mean length of stay between LBW infants on continuous KMC versus those on intermittent KMC.
c. To compare the morbidities/outcomes of LBW infants on continuous KMC versus those on intermittent KMC with regard to the following:
    i. Apnea
    ii. Sepsis rate
    iii. Oxygen support
    iv. Hypoglycemia
    v. Antibiotics

Study Design

This is a non-blinded randomized control trial.

METHODS

Forty-six (46) subjects, 23 in each group, were included that achieved 95% power and detected a difference of 8.94 between the two groups with a significance level of 0.05.

Criteria for Eligibility

All infants born at the University of the Philippines-Philippine General Hospital (UP-PGH) with the following inclusion criteria in the absence of an incubator in the NICU were included in the study:

1. Birth weight ≥ 1,800 but ≤ 2,200 grams
2. Stable (no dependency on oxygen and/or intravenous fluid, ability to at least partial feed) after the 1st 24 hours of life
3. Stable vital signs for the past 24 hours
4. Normal temperature (36.5°C-37.5°C)
5. Normal heart rate (120-160 bpm)
6. No apnea for the past 6 hours
7. No IV lines or with a well-secured peripheral line
8. No oxygen support
9. No sepsis, no emerging signs of sepsis, on IV antibiotic therapy but clinically stable
10. Can require phototherapy but with stable and not rising total serum bilirubin (TSB) levels or TSB is not in the high-risk zone

Exclusion Criteria

1. Neonates with chromosomal and life-threatening congenital anomalies
2. Severely ill
3. Neonates whose mothers are critically ill
4. Neonates admitted at the NICU level II whose mothers are unable to comply with the follow-up schedule
5. Discretion of the attending physician

STUDY PROTOCOL

Randomization

After informed consent was obtained from the parent, patients were randomized using a table of random numbers with codes placed in sequentially numbered opaque sealed envelopes by a person not involved in the study. Randomization was either to one of the two groups, namely: Continuous KMC or Intermittent KMC.

All eligible babies were weighed naked on an electronic weighing scale upon birth, upon entry into the study, and subsequently daily one hour after feeds until discharge. The infant's length was measured at birth, weekly, and on discharge using an Infantometer upon entry into the study. Head circumference (HC) and chest circumference (CC) were measured by standard methods at birth, weekly, and on discharge with a non-stretchable tape upon entry into the study. All measurements were carried out by the same research assistants.

Continuous KMC Group

Infants randomized to the continuous KMC group were roomed in with their mothers in the maternity ward (Ward 15). At this time, infants weighing less than 2,200 were routinely admitted to the NICU step-down unit. The mothers of the continuous KMC group were oriented in detail about KMC adoption. The mothers provided skin-to-skin contact using a specially tailored "kangaroo tube" made of soft semi-spandex cloth. The mothers were encouraged to keep the baby in KMC continuously for as long as possible during the day and night or at least 12 hours/day. The duration of the kangaroo care given by each of the mothers was recorded and tallied accordingly.

1. As soon as the premature/LBW baby was in stable condition, based on the attending doctor's assessment, the mother was assisted in providing KMC.
2. The stable LBW baby was placed on the mother's chest, skin-to-skin, prone between her breasts, with the head turned to one side and held close to the chest by a KMC cloth.
3. While in position, the baby's heart rate, breathing rate, and oxygenation/color were monitored hourly by a research assistant.
4. The mother was monitored for signs of anxiety, distress, or comfort level while in a kangaroo position.
5. The duration of the position was dependent on the mother and baby's tolerability, stability, and comfort and was anywhere from 6-24 hours, although at least 12 hours/day was recommended.

Infants wore only a diaper and a bonnet. Breastfeeding was the standard feeding method. However, if deemed necessary, the baby may be given breast milk using a tube or cup. When not in KMC, the bay would be clothed and covered and placed at the bedside with the mother.

Intermittent KMC Group

The infants randomized to the intermittent KMC group were admitted to the NICU II (Step Down Unit), the standard procedure at this time. Mothers were also oriented in detail about KMC. The mothers provided skin-to-skin contact using a specially tailored "kangaroo tube" provided in the continuous KMC group. The mothers were encouraged to keep the baby in KMC as long as possible whenever they visited the NICU for an accumulated time of approximately 6 hours per day. The infants in this group were discharged directly from the unit once the discharge criteria were met.

Monitoring

Babies in both groups were monitored hourly for their heart rate, respiratory rate, temperature, and color and were recorded accordingly. Babies who developed persistent hypothermia/hyperthermia, bradycardia, pathologic weight loss, sepsis, feeding intolerance were declared as having treatment failure and were withdrawn from the study.

Discharge Criteria

Low birth weight infants both in the intervention and control groups were discharged from the study according to the following criteria:

a. Baby's general health was stable as assessed by the attending physician and had no evidence of infection
b. Tolerated feeding and received exclusively breast milk
c. Gained weight (at least 15-20 grams/kg body weight/day for at least three days)
d. Able to maintain body temperature for at least three consecutive days at room temperature
e. Mother and family members showed confidence in doing KMC.

Statistical Analysis

Data was encoded using Microsoft EXCEL 2007. The original plan in comparing the anthropometrics between continuous and intermittent KMC was to do the independent T-test. However, based on the normality test, the changes in the anthropometric parameters were skewed, as shown in the minimum and maximum values. Therefore, the non-parametric counterpart of the independent T-test was used, which was the Mann-Whitney U-test. Fisher's exact test was used for the comparison of morbidities between the two groups. A p-value of <0.05 was considered significant.

Ethical Considerations

KMC was employed in the treatment and control groups, which is currently the standard for stable LBW infants. There were no invasive procedures done on the subjects, which would place their mothers in an uncomfortable and agitated condition. No identifying information was sought from participants during the study, thereby guaranteeing anonymity. There were no direct monetary or material benefits that participant received from participating in the study. The researchers and research assistants thoroughly explained to the mother/legal guardian the benefits and risks of joining the study. Informed consent was obtained and discussed with the mother/guardian by reading through the document, where they were allowed to ask questions intermittently. In this way, it was made sure that the mother/guardian understood every statement. This was done after 24 hours of life when the neonate was cleared as being stable. All participants who met the inclusion criteria but who refused to participate and those who decided to join their baby in the study, but at some point during the data collection, declined to continue were not included in the study. Those infants who were eligible but were not enrolled in the study received the standard quality of treatment they needed. All information obtained from the participants was treated with the utmost confidentiality.

RESULTS

We conducted the study from March 1, 2013, and completed 46 participants by June 30, 2013. Twenty-three infants were randomized to the continuous KMC and twenty-three to the intermittent KMC.

Characteristics of the 46 newborn participants were roughly similar between the two groups at birth (Table 1).

Table 1. Neonatal baseline characteristics of LBW infants on continuous and intermittent KMC

Variable	Continuous KMC (n =23)	Intermittent KMC (n =23)	p-value
Weight at birth (g)			
Mean (SD)	2066.09 (120.53)	2003.91 (133.20)	0.104[a]
Range	1830 – 2200	1800 – 2200	
Weight at enrollment (g)			
Mean (SD)	2066.30 (120.41)	2014.13 (122.65)	0.153[a]
Range	1830 – 2200	1810 – 2200	
Gestational age (week)			
Mean (SD)	36.13 (1.22)	35.83 (0.94)	0.347[a]
Range	34 – 38	34 – 37	
Sex, %			
Male	60.9	52.2	0.552[b]
Female	39.1	47.8	
Gestational age group, %			
33-34 weeks	17.4	4.4	0.053[c]
35-36 weeks	30.4	65.2	
≥ 37 weeks	52.2	30.4	
Anthropometry			
Length (cm)			
Mean (SD)	44.45 (1.62)	43.87 (1.63)	0.233[a]
Range	42 – 49	40.5 – 47	
Head circumference (cm)			
Mean (SD)	30.86 (1.04)	30.77 (1.06)	0.788[a]
Range	29 – 33.5	28 – 33	

[a] *T-test*
[b] *Chi-square test*
[c] *Fisher's exact test*

There was no significant difference in birth weight, weight at enrollment, gestational age, gender, length, and head circumference. Still, it was noted that in the breakdown of gestational age, there were more infants within 33-34 weeks gestational age belonging to the continuous KMC with four infants at 34 weeks gestational age while only one at 34 weeks in the Intermittent KMC and majority in the Intermittent KMC belonged to 35-36 weeks gestational age where eight participants were at 35 weeks (Table 1).

Table 2 shows no significant difference as to the weight changes (70.48 g versus 91.13 g, = 0.509), length (0.39 cm versus 0.29 cm, p=0.755), head circumference (0.45 cm versus 0.17 cm, p=0.334) and chest circumference (0.31 cm versus 0.27 cm, p=0.557). However, there is a note of weight loss in two participants of the Intermittent KMC.

Two participants in the Continuous KMC group and four in the Intermittent KMC group developed hypothermia, but this was not statistically significant. One participant developed hyperthermia belonging to the Continuous KMC group, which lasted for a few hours only and showed no other clinical symptoms indicating a possible infection. The difference in duration of hospital stay in the Continuous KMC group was not statistically significant with the Intermittent KMC group.

There was no significant difference between episodes of hypothermia, hyperthermia, and duration of hospital stay between the two groups. However, it is noted that one participant in Intermittent KMC was diagnosed with sepsis and was treated accordingly (Table 3).

DISCUSSION

KMC by promoting exclusive breastfeeding, ensuring temperature maintenance, facilitating physiologic stability, and decreasing neonatal morbidities could result in improved physical and cognitive growth.[17] Our results showed almost identical results from continuous and intermittent KMC groups on weight gain and duration of hospital stay.

The nadir of weight loss occurs by 4-6 days of life, and then weight gain starts and birth weight regained by 14-21 days of life.[18] Our discharge criteria for LBW babies were at least 15-20 grams/kg body weight/day for three consecutive days. So, we could not confirm when the birth weight was regained, but the average duration needed for

Table 2. Comparison of anthropometric parameters between LBW infants on continuous and intermittent KMC

Variable	Continuous KMC (n =23)	Intermittent KMC (n =23)	p-value*
Weight gain (g/day)			
Mean (SD)	70.48 (69.14)	91.13 (129.42)	0.509
Median	50	48	
Range	17 – 365	-60 – 565	
Length gain (cm/week)			
Mean (SD)	0.39 (0.57)	0.29 (0.44)	0.755
Median	0.20	1.00	
Range	0 – 2.10	0 – 1.5	
Head circumference (cm/week)			
Mean (SD)	0.45 (1.09)	0.17 (0.32)	
Median	0	0	0.334
Range	0 – 5.1	0 – 1	
Chest circumference (cm/week)			
Mean (SD)	0.31(0.43)	0.27 (0.42)	
Median	0.20	0	0.557
Range	0 – 1.6	0 – 1.30	

** Mann-Whitney U-test*

Table 3. Comparison of morbidities and duration of hospital stay between LBW infants on continuous and intermittent KMC

Variable	Continuous KMC (n =23)	Intermittent KMC (n =23)	p-value
Hypothermia, %	13.04	17.39	1.000[a]
Hyperthermia, %	4.35	0.0	1.000[a]
Sepsis, %	0.0	4.35	1.000[a]
Duration of hospital stay			
Mean (SD)	3.48 (1.44)	4.83 (3.26)	0.218[b]
Median	3.0	4.0	
Range	1 – 7	1 – 15	

[a] Fisher's exact test
[b] Mann-Whitney U-test

weight gain after starting KMC was 3-4 days. Studies have shown and proved that KMC babies had better average weight gain per day**.** A study done by Suman Rao et al. from Mumbai, India, showed an average weight gain of 23.99 grams in the KMC group.[19] Similarly, the experience of Gupta M. et al. from Rajasthan India showed an average weight gain of 21.3 grams/day and K. Ramanathan, V.K. Paul et al. from Delhi found average weight gain in KMC babies after the first week of life was 15.9 grams/day.[20,21] Subedi K. et al. from Nepal had an average weight gain of 30.35 grams/day.[22] A Cochrane review by Conde-Agudelo A et al. on KMC to reduce morbidity and mortality in LBW infants showed infants had gained more weight per day by discharge than controls (weighted mean difference 3.6 g/day, 95% CI 0.8 to 6.4). However, these differences were of low clinical significance.[23]

In our study, there was a note of weight gain for both groups that underwent KMC. It showed an average weight gain of 50 grams/day for the Continuous KMC group and 48 grams/day for the Intermittent KMC group. There was no significant difference in weight gain between the two groups since the initiation of early and exclusive breastfeeding is one of the components of KMC which was carried out in both groups and may have contributed to their weight gain. Further, mothers in the Continuous group were advised to provide KMC as long as possible, but most only did this for 12 hours on review.

As demonstrated by various studies, KMC has been proven to reduce the number of hospitals stay. Gupta M, Jora R et al. observed mean duration of hospital stay was 15.5 days.[20] In Delhi studies average day of hospital stay was 27.2 ± 7 days.[21] While in Nepal, Subedi K. et al. had an average hospital stay of 8.99 days.[22] Cochrane reviews by Conde-Agudelo A. et al. showed the mean hospital stay from randomization to 41 weeks' corrected gestational age was 4.5 days for KMC infants and 5.6 for control infants in the Charpak 1997 study.[23] Cattaneo in 1998 only reported median hospital stay, which was 11 days in the KMC group, compared to 13 days in the control group. Length of hospital stay was two days greater in KMC infants than control infants in the Sloan 1994 study.[24]

In our research, there were three days duration of hospital stay for the Continuous KMC group but was not statistically significant with p=0.218 compared to the Intermittent KMC group.

Results of secondary outcomes were partly consistent with previous publications. The effect of earlier KMC on reduced infection and readmission were similar to those reported by Charpak et al.[25] There were no apparent signs of sepsis in participants from the Continuous KMC group, and only 1 participant was diagnosed with an infection from the Intermittent KMC group but did not require any oxygen support. Six of the infants in the study experienced hypothermia but were not persistent and not statistically significant between the two groups. There was one participant from Ward 15 with episodes of hyperthermia belonging to the Continuous KMC group. However, in a study by Shuko Nagai et al., one-third of the infants experienced hyperthermia during hospitalization. Still, the frequency was not significantly different between earlier and later KMC groups.[14] A recent RCT from India also reported a high proportion of hyperthermia in both groups (KMC group: 13 /103 (12.6%), conventional care group 18 /103 (17.5%), p = 0.33).[24] There was no participant in the study who developed apnea.

CONCLUSION

There was no evidence to show that continuous KMC differed significantly from intermittent KMC on weight gain and shorter duration of hospital stay. Almost identical results were obtained as to secondary outcomes of hypothermia, hyperthermia, and sepsis between the two groups.

Recommendation

In this study, continuous KMC was only for at least 12 hours/day. We recommend further studies in which the Continuous KMC group will have the endorsed duration of at least 18 hours/day. A longer period of continuous KMC (≥ 18 hours/day) may show greater weight gain and duration of hospital stay. A post-discharge follow-up that may further document a significant weight gain in these patients is recommended.

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Abbreviations

KMC - Kangaroo mother care
LBW - Low birth weight
NICU - Neonatal intensive care unit
WCA - Weeks of the conceptual age
TSB - Total serum bilirubin
HC - Head circumference
CC - Chest circumference

Definition of Terms

Low birth weight – Weight at birth less than 2,500 grams

Continuous kangaroo mother care – Baby is carried in the KMC position ≥ 12 hours per day

Intermittent kangaroo mother care – Baby is held in the KMC position for an accumulated time of ≤ 6 hours per day

Statement of Authorship

All authors contributed in the conceptualization of work, acquisition and analysis of data, drafting and revising, and approved the final version submitted.

Author Disclosure

All authors declared no conflicts of interest.

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