

# Management of preterm low birth weight infants in Dhaka: a comparison between Standard Care and Kangaroo Mother Care

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## Abstract

In Bangladesh, government healthcare facilities are adopting Kangaroo Mother Care (KMC) more extensively for preterm low birth weight (LBW) infants to reduce neonatal deaths in the country. A quasi-experimental study was carried out to compare KMC and Standard Care (SC) outcomes for preterm LBW babies. Data were collected from December 2017 to June 2018. The study focused on the preterm neonates admitted to Bangabandhu Sheikh Mujib Medical University (BSMMU) Hospital, Dhaka. A total of 25 neonates under KMC and 25 neonates under SC were enrolled from the initial study population. The study revealed that during the length of hospital stay, the incidence of hypothermia (4% in KMC vs. 24% in SC) and hyperthermia (8% in KMC vs. 32% in SC) and clinical late-onset sepsis (36% in KMC vs. 64% in SC) were significantly lower among neonates of KMC. Times to first feed ( $1.80 \pm 0.40$  in KMC vs.  $2.20 \pm 0.42$  in SC) and to full enteral feeding ( $8.32 \pm 2.49$  in KMC vs.  $19.56 \pm 6.80$  in SC) were also found to be significantly shorter among KMC neonates. Moreover, KMC mothers show adequate breastfeeding more often than in SC group (88% in KMC vs. 64% in SC). On the other hand, a higher proportion of SC neonates compared to KMC neonates were found to have feeding intolerance (56% in SC vs. 8% in KMC), hyperglycaemia

(24% in SC vs. 4% in KMC) and apnoea (32% in SC vs. 8% in KMC). Finally, mean hospital stay ( $12.04 \pm 2.74$  days in KMC vs.  $25.24 \pm 7.20$  days in SC) and mean treatment cost (9,508  $\pm$  4,142 Taka in KMC vs. 35,064  $\pm$  13,352 Taka in SC) were found to be significantly lower for KMC. In conclusion, KMC seems to be a safe and effective method of care for preterm LBW infants in a limited resources health care setting.

## Keywords

Kangaroo Mother Care, Standard Care, neonatal care, preterm infant, low birth weight, length of hospital stay.

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## Introduction

Preterm low birth weight (LBW) is a major problem worldwide. Ten countries account for 60% of world preterm births. Bangladesh ranks seventh among them [1]. Comparison of the neonatal, infant and Under-5 mortality rates in Bangladesh over the last 20 years reveals that neonatal mortality declined at a slower pace than infant and child mortality [2]. In 2015, the Under-5 deaths in Bangladesh were 38/1,000 live births and neonatal mortality was 23/1,000 live births. In 2015 prematurity, birth asphyxia/birth trauma and neonatal sepsis accounted for 29.7%, 22.9% and 19.9% of neonatal deaths, respectively [3]. Among these causes of death, neonatal late-onset sepsis (LOS) in preterm/LBW infants is particularly preventable by Kangaroo Mother Care (KMC). Moreover, effective implementation of KMC at home after hospital discharge reduces

stress and increases comfort and parenting confidence [4].

Management of LBW infants by the conventional method of care is expensive in terms of human and material resources, representing even a higher challenge in low-income countries [5]. KMC was originally developed in Bogotá (Colombia) by pediatricians Rey and Martinez. It provides skin-to-skin contact, thermal control, support for early and exclusive breastfeeding and possibly early recognition and response to illness. KMC can be started for preterm babies after birth as soon as the baby is clinically stable, and can be continued during the hospital stay and at home until around the time the baby would have been born [6]. KMC neonates are at intimate contact with mother, experience maternal heart sounds, rhythmic maternal breathing and warmth, and receive gentle stimulation across the auditory, tactile, vestibular and thermal sensory systems [7, 8]. Thus the contact with the mother makes newborn infants more stable, reduces crying and response to pain, and promotes brain development. On the other hand, the mother becomes more sensitive and alert to the infant's behavior [8, 9].

In 2015, the World Health Organization (WHO) recommended KMC for the routine care in health facilities of newborns weighing 2,000 grams or less at birth, starting as soon as the newborns are clinically stable [10]. In Bangladesh, KMC is a relatively recent practice. In fact, a 2013 Act of Bangladesh Government integrated the KMC into newborn care for preterm/LBW infants to reduce neonatal deaths [11]. On the contrary, implementation of KMC at a community level is still limited, mainly due to the mothers' heavy household workload and poor motivation on the part of health care providers [11, 12].

This study was designed to explore the outcome of comparing KMC and SC in a population of preterm, LBW infants.

## Materials and methods

This quasi-experimental study was carried out in the Department of Neonatology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from December 2017 to June 2018. Study sample was constituted by preterm LBW infants admitted to the Department of Neonatal Intensive Care Unit (NICU) who were haemodynamically stable with no severe respiratory problem. Neonates with severe

perinatal asphyxia, requiring ventilator support or inotropic therapy, life-threatening congenital malformation, and having critically ill mothers were excluded from the study. Moreover, neonates of parents unable to comply with the follow-up schedule or refusing KMC intervention were also excluded from the study. Enrolled neonates were allocated sequentially and alternatively to KMC or Standard Care (SC). Ultimately, 50 neonates were included in the study, 25 neonates in the KMC group and 25 in the SC group. As soon as the neonates were admitted to the hospital, their parents were given information on both the methods of care and an informed verbal consent was taken. Mothers participating to the study were trained on their duties in the management of KMC as well as SC infants. KMC was initiated as soon as the baby was stable. KMC mothers provided skin-to-skin contact with their babies dressed with cap, socks, and diapers and supported at the bottom with a sling/binder. Adequate privacy was ensured and proper chairs and beds were provided to KMC mothers. Skin-to-skin contact was given for a minimum of 1 hour at a time and at least for 12 hours/day, gradually increasing its duration as long as the mother and baby felt comfortable. Whenever KMC was discontinued, babies were placed in the cot adequately clothed and covered. A KMC chart was given to mothers to record the duration of KMC sessions. Whenever the mother was unable to fill up the chart, a reliable family member was arranged for her. Similarly, SC mothers provided care according to the instruction received. SC was provided by nurses and doctors on rotation duty. Thermal control SC neonates were managed with radiant warmers as required. In both KMC and SC groups, mothers were allowed to handle their babies at any time of the day.

In both groups, babies were provided milk, vitamin and minerals supplementation according to our current hospital feeding protocol. During the hospital stay, neonatal monitoring both in KMC and SC groups included daily weight by an electronic scale, physiological parameters (axillary temperature, heart rate, respiratory rate, and oxygen saturation) and parameters of feeding intolerance (vomiting, abdominal distension, characteristics of the nasogastric residual and of stool). Babies who developed feeding intolerance were managed by the doctor on duty according to the suggestions of a consultant. Episodes of hypothermia, apnoea, nosocomial sepsis, hyperbilirubinemia, necrotizing enterocolitis were also monitored and recorded.

Day of first feed, time to reach full enteral feeding and time to regain birth weight were also recorded. Full enteral feeding was considered as reaching effective breastfeeding or getting 150 ml/kg/day milk by nasogastric tube or dropper. Breastfeeding was considered effective if the baby suckling was adequate, feeds were at least eight per day, urine output at least six times per day, weight gain was at least 10-15 g/kg/day, and the mother was confident. Cost during the hospital stay was calculated on the basis of bill payment sheet, investigation and medication costs. Infants in both groups were discharged when the baby was in general good health conditions, feeding well, receiving breast milk directly or by cup-spoon and gaining at least 15-20 g/kg/day for three consecutive days, body temperature was normal at room temperature without warming devices for at least three consecutive days and the mother and family members were confident to take care of the baby. After discharge, neonates were followed weekly until 40 weeks postconceptional age.

Mothers of both groups were interviewed face-to-face using a dedicated questionnaire. Moreover, during follow-up, information collected through infants' observation and measurement of different parameters were recorded on a checklist sheet.

Windows SPSS® (Statistical Package for Social Sciences) Version 20.0 was used for data analysis. Ethical clearance was obtained from the Research Ethics Committee of Faculty of Allied Health Sciences (REC-FAHS), Daffodil International University (DIU), Dhaka, Bangladesh.

## Results

Enrolled newborn infants had a birth weight between 1,250 to 1,800 grams and a gestational age of 31-36 weeks. No significant differences in birth weight, gestational age and birth weight per gestational age were documented between the KMC and SC groups (**Tab. 1**). The Lubchenco's charts show that most KMC newborns (92%) and SC newborns (72%) were found to be appropriate for gestational age. Regarding the sex distribution, the KMC group included a higher proportion of males (64%) compared to the SC group.

In our facility, most deliveries in the KMC as well as in the SC group were conducted by a doctor (**Tab. 2**). Eighty percent (80%) of KMC and 68% of SC deliveries were lower uterine caesarian section (LUCS). Normal deliveries were carried out by a trained birth attendant (TBA) under the

**Table 1.** Categorization of the study population according to gestational age, birth weight, birth weight per gestational age and sex.

Characteristics		KMC (n = 25)	SC (n = 25)	Test of significance
Gestational age (weeks)	30-32	12 (48%)	9 (36%)	Fisher's Exact Test p = 0.752
	33-34	9 (36%)	11 (44%)	
	35-37	4 (16%)	5 (20%)	
	Mean ± SD	32.96 ± 1.27	33.16 ± 1.40	t = -0.529; p = 0.600
Birth weight (grams)	1,250-1,400	4 (16%)	5 (20%)	Fisher's Exact Test p = 1.000
	1,401-1,600	8 (32%)	8 (32%)	
	1,601-1,800	13 (52%)	12 (48%)	
	Mean ± SD	1,566 ± 155.94	1,533 ± 146.13	t = 0.772; p = 0.440
Sex distribution	Male	16 (64%)	10 (40%)	$\chi^2 = 2.885$ ; p = 0.089
	Female	9 (36%)	15 (60%)	
Weight/gestational age	Appropriate for gestational age	23 (92%)	18 (72%)	Fisher's Exact Test p = 0.138
	Small for gestational age	2 (8%)	7 (28%)	

Data are presented as n (%) if not otherwise stated.  
KMC: Kangaroo Mother Care; SC: Standard Care.

**Table 2.** Type of delivery and neonatal health conditions at childbirth.

Physical conditions		KMC (n = 25)	SC (n = 25)	Test of significance
Delivery conducted by	Doctor	22 (88%)	20 (80%)	Fisher's Exact Test p = 0.702
	TBA	3 (12%)	5 (20%)	
Type of delivery	Normal vaginal delivery	5 (20%)	7 (28%)	-
	LUCS	20 (80%)	17 (68%)	
	Assisted vaginal delivery	0 (0%)	1 (4%)	
First cry	Immediate	18 (72%)	23 (92%)	Fisher's Exact Test p = 0.138
	Delayed	7 (18%)	2 (8%)	
Apgar score at 5 minutes	Mean ± SD	8.40 ± 0.70	8.28 ± 0.67	t = 0.619; p = 0.537
Resuscitation required	Yes	7 (28%)	3 (12%)	Fisher's Exact Test p = 0.289
	No	18 (72%)	22 (88%)	

Data are presented as n (%) if not otherwise stated.  
KMC: Kangaroo Mother Care; LUCS: lower uterine caesarian section; SC: Standard Care; TBA: traditional birth attendant.

supervision of a gynaecologist. More than one-fourth of the neonates in KMC (28%) and 12% in the SC group required resuscitation. A lower proportion of neonates in the KMC group (72%) was found to cry immediately after birth compared to that of neonates in SC (92%). Apgar score at 5 minutes was very similar in KMC (8.40 ± 0.70) and in the SC group (8.28 ± 0.67).

In the KMC group, fewer neonates were found to suffer from either hypothermia or hyperthermia and a lower percentage of LOS was identified (**Tab. 3**).

In our study, KMC neonates started feeding earlier, reached full enteral feeding earlier, had a lower incidence of feeding intolerance, started

breastfeeding earlier and attained adequate breastfeeding more frequently (**Tab. 4**).

When compared to KMC neonates, SC neonates showed a higher proportion of hypoglycaemia, hyperglycaemia, neonatal jaundice and apnoea, while a significant difference was found only for apnoea (**Tab. 3**).

KMC neonates started to regain weight after birth earlier than SC neonates and attained birth weight more rapidly than SC neonates. Moreover, weight, head circumference and length growth were found significantly higher among KMC neonates. Finally, the KMC group had a shorter length of hospital stay with a lower cost of hospitalization (**Tab. 5**).

**Table 3.** Neonatal clinical conditions.

Clinical condition		KMC (n = 25)	SC (n = 25)	Test of significance
Thermal condition	Hypothermia	1 (4%)	6 (24%)	Fisher's Exact Test p = 0.004
	Hyperthermia	2 (8%)	8 (32%)	
	Normal	22 (68%)	11 (44%)	
Morbidities	Clinical LOS	9 (36%)	16 (64%)	$\chi^2 = 3.920$ ; p = 0.048
	LOS confirmed by a positive blood culture	0/9 (0%)	6/16 (24%)	p = 0.057
	Hypoglycaemia	1 (4%)	5 (20%)	Fisher's Exact Test p = 0.189
	Hyperglycaemia	1 (4%)	6 (24%)	Fisher's Exact Test p = 0.098
	Apnoea	2 (8%)	8 (32%)	$\chi^2 = 4.500$ ; p = 0.034
	Neonatal jaundice	16 (64%)	19 (76%)	$\chi^2 = 0.857$ ; p = 0.355

Data are presented as n (%).

KMC: Kangaroo Mother Care; LOS: late-onset sepsis; SC: Standard Care.

**Table 4.** Feeding parameters.

Feeding factors	KMC (n = 25)	SC (n = 25)	Test of significance
First feed (days after birth), mean $\pm$ SD	1.80 $\pm$ 0.40	2.20 $\pm$ 0.42	t = -3.448; p = 0.001
Time to full enteral feeding (days after birth), mean $\pm$ SD	8.32 $\pm$ 2.49	19.56 $\pm$ 6.80	t = -7.761; p = 0.000
Time of first breast feed (days after birth), mean $\pm$ SD	9.6 $\pm$ 2.16	20.12 $\pm$ 3.82	t = -11.966; p = 0.000
Adequacy of breast milk at hospital discharge	22 (88%)	16 (64%)	$\chi^2 = 3.947$ ; p = 0.047
Exclusive breast feeding	25 (100%)	23 (92%)	Fisher's Exact Test p = 0.491
Feeding intolerance	2 (8%)	14 (56%)	$\chi^2 = 13.235$ ; p = 0.000

Data are presented as n (%) if not otherwise stated.

KMC: Kangaroo Mother Care; SC: Standard Care.

**Table 5.** Hospital stay and cost for hospitalization.

Outcome	KMC (n = 25)	SC (n = 25)	Test of significance
Beginning of weight gain (days)	9.92 $\pm$ 1.55	14.96 $\pm$ 2.31	t = -9.059; p = 0.000
Birth weight regain (days)	16.56 $\pm$ 6.29	22.76 $\pm$ 7.20	t = -3.242; p = 0.002
Weight gain (g/day)	27.08 $\pm$ 3.02	16.11 $\pm$ 2.76	t = 13.407; p = 0.000
Head circumference gain (cm/week)	0.86 $\pm$ 0.09	0.81 $\pm$ 0.08	t = 2.076; p = 0.042
Length gain (cm/week)	0.99 $\pm$ 0.16	0.91 $\pm$ 0.10	t = 2.120; p = 0.042
Hospital stay (days)	12.04 $\pm$ 2.74	25.24 $\pm$ 7.20	t = -8.567; p = 0.000
Cost of treatment (Taka <sup>a</sup> )	9,508 $\pm$ 4,142	35,064 $\pm$ 13,352	t = -9.134; p = 0.000

Data are presented as mean  $\pm$  SD.

<sup>a</sup>Taka is the Bangladeshi currency (1 Bangladeshi Taka = 0.011 Euro, as of June 2019).

KMC: Kangaroo Mother Care; SC: Standard Care.

## Discussion

KMC is the practice of providing continuous skin-to-skin contact between mother and baby, exclusive breast milk feeding, and early discharge from the hospital. Scientific literature demonstrates that in limited resources countries,

KMC improves the survival of the neonates by decreasing the mortality and morbidity in preterm and LBW infants. In fact, KMC provides protection from sepsis, adequate thermal control and activation of respiratory nervous centers [13-15]. Moreover, KMC encourages mother-baby bonding and promotion of breastfeeding,

possibly contributing to improve infant growth [13-15].

The present study shows similar findings for KMC neonates, confirming its health benefits. A significantly lower proportion of the KMC neonates was found to develop thermal control problems (hypothermia and hyperthermia) and LOS (neonatal infection with an onset after the first 72 hours of life) [16]. We must appreciate that the preventive effect of KMC on LOS is particularly relevant in the context of BSMMU, a public hospital overcrowded with patients and visitors, with a high incidence of hospital-acquired infections. Although in our study 50% of the neonates were suspected of having LOS, a clinical diagnosis was confirmed by a positive blood culture only in the SC group. In this study, 70% of neonates developed jaundice, treated with phototherapy and frequent feeding, without significant differences between KMC and SC groups [17].

The higher percentage of neonates of SC group suffering from LOS might be due to suboptimal antiseptic procedures in handling neonates in SC group neonates by several health professionals. As in KMC each mother takes care of her own baby, who enters in contact mainly with germs hosted by her/his mother and is fed more often with mother's own milk, which provides immunological protection to the fragile neonate, infection risk is consequently markedly reduced. Mother's own milk positively affects gut microbiota and also shapes the gut in early life, facilitating allergy prevention [18].

Although KMC has a documented promoting effect on breastfeeding, we did not find any difference in exclusive breastfeeding rate between KMC and SC groups. This may be due to the special support on breastfeeding provided by the breastfeeding corner in government hospitals where mothers are encouraged and trained to practice exclusive breastfeeding [19]. The personnel of the breastfeeding corner creates awareness among mothers on the benefits of breastfeeding. They also train the mother on the proper way to breastfeed. As both KMC and SC mothers can benefit from this programme on the promotion of breastfeeding, breastfeeding rate in the two groups might be similar.

In accordance with published literature, KMC neonates demonstrated a better growth in comparison to SC neonates.

As a consequence of the improved health conditions and of the more rapid attainment of full

feeding, the duration of hospital stay among KMC neonates was almost half that of the SC neonates and the cost for health care was definitely lower.

Although the existing limitations of a small sample size and lack of randomization, our study demonstrated the health and economic benefits of KMC, corroborating the results of other studies carried out elsewhere in Bangladesh and in other countries [20-24].

Bangladesh Government has adopted the WHO Practical Guide for KMC as part of newborn and maternal health plan [18]. Despite the Government's sincere effort, there are some constraints to the implementation of KMC in our country. Major issues raised by mothers are the following: 1) keeping the baby in KMC position in hot and humid weather is uncomfortable, 2) long staying in the health facility is a restrictive option, 3) coming back to the hospital after discharge for follow-up visits is logistically complicated. On the other hand, health professionals may have a suboptimal motivation to promote and sustain KMC and the population may not be aware of the effectiveness of KMC [25, 26]. A qualitative study report on Community level delivery of KMC stated that KMC is applicable for sick babies, but was less acceptable as a protective method of care for healthy newborns during the first few days of life [27].

## Conclusion

In our settings, KMC was found to carry health and economic benefits in the care of preterm/LBW infants. It improves thermal control, reduces the incidence of sepsis and improves growth. Consequently, KMC allows newborn infants to go home earlier, thus reducing hospitalization costs.

In conclusion, as KMC is an effective method of care, a further impulse to implement and disseminate KMC in the health facilities of Bangladesh is expected. Information to families and motivation of health professionals seem to be a pivotal component.

## Declaration of interest

The Authors declare that there is no conflict of interest. No funding received.

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