

ORIGINAL ARTICLE

# Effects of Intermittent Kangaroo Mother Care in Preterm Low Birth Weight Babies: A Randomized Controlled Trial

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## Abstract

**Background:** Prematurity is the largest cause of neonatal mortality. They need incubators or radiant warmers which are expensive and very difficult to arrange in a resource constraint country. Kangaroo mother care (KMC) had been proposed as an alternative to conventional neonatal care for low birthweight (LBW) babies.

**Objectives:** To observe the benefits of Kangaroo mother care in preterm low birth weight babies.

**Methods:** This randomized controlled trial was conducted over 6 months in Dhaka Shishu Hospital. Neonates who were <1800 gm and hemodynamically stable were enrolled. Total 80 neonates were enrolled and divided into 2 groups: Kangaroo mother care group and conventional method care group (incubator/warmer). The mother or caregiver were taught for KMC, supervised by trained nurses round the clock. KMC was given at least 2 hours at a time and at least 12 hours in a day. When the baby was not in KMC at that time the baby was placed in cot with adequate coverings. During hospital stay both the groups were monitored.

**Results:** In KMC group 25% and conventional care group 40% neonates became hypothermic. Among the study population 35% neonates in KMC and 65% neonates in conventional care groups developed sepsis ( $p = 0.007$ ). More KMC babies were exclusively breastfed at the end of the study (95% vs 60%). The KMC babies had shown better growth: weight gain per day ( $18.35 \pm 7.81$  grams vs  $13.55 \pm 4.89$   $p < 0.001$ ) and length ( $0.99 \pm 0.70$  vs  $0.71 \pm 0.44$  cm,  $p = 0.03$ ). KMC babies were discharged earlier than conventional care baby.

**Conclusion:** KMC provides significant improvement in exclusive breast feeding, reduction of infection, decrease hospital stay and gaining weight of the babies. It also helps in maintaining temperature better than conventional care.

**Keywords:** Kangaroo mother care, conventional care, exclusive breast feeding, growth, thermal control.

## Introduction

Birth weight is a significant determinant of newborn survival. Prematurity is the largest direct cause of neonatal mortality.<sup>1</sup> In Bangladesh reported rate of neonatal mortality and morbidity varies from 31-50%.<sup>2</sup> One of the main reasons that LBW/premature

babies are at a greater risk of illness and death because of their lack of ability to control body temperature; they become hypothermic very quickly.<sup>3</sup> Prematurity and low birth weight are associated with increased bacterial infections<sup>4</sup> and vulnerable to develop respiratory distress syndrome

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(RDS), necrotizing enterocolitis (NEC), patent ductus arteriosus (PDA), intra-ventricular haemorrhage (IVH) and long term sequelae such as retinopathy of prematurity, chronic lung disease and developmental disabilities. Well thermal control, monitoring of heart rate and respiratory rate, oxygen therapy, maintenance of fluid and electrolyte, special attention to nutritional support and safeguard against infection are the corner stone of management of these neonates.<sup>5</sup> Neonatal intensive care of LBW babies is difficult in developing countries due to high cost, difficulty in maintenance and repair of equipments, intermittent power supply, inadequate cleaning of instruments and shortage of skilled staff. For sharing the incubator, risk of infection is very high.<sup>6</sup> There is an alternative approach for providing thermal care and improving survival of LBW infants that is both effective and affordable-namely, Kangaroo Mother Care, or KMC.<sup>1</sup> The introduction of Kangaroo mother care has resulted in improved preterm infants outcome including decreased infant pain sensation and stress, improved breast-feeding success as well as improved development and growth in the neonatal Intensive Care Unit (NICU). The KMC has been associated with improvements in short and long-term neonatal care health outcome to date.<sup>7</sup> The length of KMC should be up to 20+ hours a day. But as Bangladesh is hot and humid country it was very difficult to continue KMC for 20 hours for this we recommend short session of KMC also known as intermittent KMC which can be started during medical treatment, each session of KMC should be minimum 2 hours and at least 12 to 16 hours a day. It is one of the government's four priority neonatal interventions. To achieve Sustainable Development Goal (SDG) we need to significantly reduce preterm deaths. The socio economic, cultural and environmental context of our country is different from many other countries in Europe, Africa where most of the studies have been done. Very few studies have been done on KMC in Bangladesh. So we proposed to do a study in our setting to see its efficacy and its acceptance by our mothers and other caregivers, so that it helps to motivate the policy makers, stake holders and the professional people to implement the method for better care of our preterm babies.

## Materials and Methods

This prospective randomized controlled trial was conducted in a tertiary hospital, Dhaka Shishu (Children) Hospital (DSH) over 6 months period from August 2016 to January 2017. Eighty neonates were enrolled according to the inclusion (stable neonate with birth weight 1250 to 1800 gm, gestational age between 30 to 35 weeks) and exclusion criteria (major congenital malformation, severe perinatal asphyxia, babies requiring ventilator or ionotropic support, critically ill mother, caregiver not interested to give KMC, having birth weight <1250 gms or >1800 gms, gestational age <30 weeks or >35 weeks).

They were divided into 2 groups: Case (K) kangaroo mother care group and control (C) conventional method care group. Randomization was achieved by simple randomization and allocation was concealed by sealed envelope. KMC was initiated as soon as the baby was stable. In KMC group mother or caregiver, father and other family members were counseled at a time explained about what is KMC, the benefits of KMC in terms of feeding, weight gain, temperature maintaining and control of infection. They were also counseled how to maintain household work during KMC. The baby was provided skin to skin contact with mother or care giver in upright position dressed with a cap, socks and diaper and supported in bottom with a sling/binder. Mother was provided with front open gown. Adequate privacy was ensured. Comfortable bed or chair was provided to mother or caregiver practicing KMC in ward. KMC was given at least 2 hours at a time and at least 12 hours in a day. All the babies were on breast milk either through nasogastric tube or by cup spoon later on breast feeding was started. The KMC chart was maintained by doctor and KMC nurses in the ward. In between KMC session babies placed in cot with adequate cloths and coverings. Neonates with conventional method (CMC) group were managed under radiant warmer and incubator.

During hospital stay both the groups were monitored. Regular follow up of temperature, apnoea, gastrointestinal symptoms, feeding, growth parameter and septic screening were done for both groups.

After discharge, the neonates were followed weekly up to 40 weeks of corrected gestational age at DSH in a follow up room and babies weight, length, OFC were measured. Every time mother were counseled about feeding practice and danger sign.

Ethical permission was taken from Ethical Review Board of Bangladesh Institution of Child Health. Data were compiled and analyzed with the help of SPSS version 21.0. Comparison was done by unpaired student's 't' test and chi square ( $\chi^2$ ) test. A probability value (p) of less than 0.05 was considered to indicate statistical significance.

## Results

Total 80 neonates were enrolled, 40 in each group. Two neonates in KMC group and three in conventional care group died during hospital stay so 38 patients in KMC and 37 in control group were completed follow up to 40 weeks of corrected gestational age. There were no significant difference in age on admission, sex, birth weight, mode of delivery, H/O PROM, first cry between two groups (Table I).

Variables	Case (K) n=40 No (%)	Control (C) n = 40 No (%)	p value
Age on admission (days, mean±SD)	1.80±1.09	2.10±1.19	0.244 <sup>ns</sup>
Sex			
Male	24(60.0)	28(70.0)	
Female	16(40.0)	12(30.0)	0.348 <sup>ns</sup>
Birth weight (gm)			
1250-1499	23(57.5)	22(55.0)	
1500-1800	17(42.5)	18(45.0)	0.821 <sup>ns</sup>
Mode of delivery			
NVD	26(65.0)	22(55.0)	0.361 <sup>ns</sup>
LUCS	14(35.0)	18(45.0)	
PROM			
Yes	20(50.0)	24(60.0)	0.369 <sup>ns</sup>
No	20(50.0)	16(40.0)	
First cry			
Immediate	5(12.5.0)	2(5.0)	0.235 <sup>ns</sup>
Delayed	35(87.5.0)	38(95.0)	

Unpaired 't' test was done in quantitative variables and  $\chi^2$  test was done in qualitative variables

There were no significant difference between case and control group in occurrence of hypothermia, apnoea and hypoglycemia. This table also shows that 14(35%) neonates of case (K) and 26(65%) neonates of control (C) were diagnosed as suspected sepsis which was statistically significant and 4(28.6%) neonates of case and 8(30.8%) neonates of control group was diagnosed as culture proven sepsis (Table II).

Variables	Case (K) (n=40) No (%)	Control (C) (n=40) No (%)	p value <sup>#</sup>
Hypothermia			
Yes	10(25.0)	16(40.0)	0.152 <sup>ns</sup>
No	30(75.0)	24(60.0)	
Apnoea			
Yes	10(25.0)	14(35.0)	0.329 <sup>ns</sup>
No	30(75.0)	26(65.0)	
Hypoglycemia			
Yes	16(40.0)	12(30.0)	0.348 <sup>ns</sup>
No	24(60.0)	28(70.0)	
Suspected sepsis			
Yes	14(35.0)	26(65.0)	0.007 <sup>**</sup>
No	26(65.0)	14(35.0)	
Culture proven sepsis			
Yes	4(28.6)	26(65.0)	0.884 <sup>ns</sup>
No	10(71.4)	14(35.0)	

<sup>#</sup> $\chi^2$  test, n=Total number of subjects, \*=Significant; \*\*=Highly significant; ns=Not significant

The mean days to reach full enteral feeding was 9.35±3.95 days and 14.35±6.06 days in case and control group respectively and was statistically significant. Exclusive breast feeding rate was 95% and 60% during discharge from hospital in case and control group respectively and that was statistically significant. There was no significant difference in feeding intolerance between two groups (Table III).

**Table III***Distribution of two groups related to feeding*

Hospital course	Case (K) (n=40) No. (%)	Control (C) (n=40) No. (%)	p value
Start of first feed on			
1 <sup>st</sup> day	14(35.0)	8(20.0)	0.133 <sup>ns</sup>
2-3 days	20(50.0)	20(50.0)	1.00 <sup>ns</sup>
4-5 days	6(15.0)	12(30.0)	0.108 <sup>ns</sup>
Time (days) to achieve full enteral feeding	9.35±3.95	14.35±6.06	<0.001*
Episode of feed intolerance			
Yes	8(20.0)	12(30.0)	0.302 <sup>ns</sup>
No	32(80.0)	28(70.0)	
Exclusive breast feeding (at discharge)			
Yes	38(95.0)	24(60.0)	<0.001**
No	2(5.0)	16(40.0)	

Unpaired 't' test was done in quantitative variables and  $\chi^2$  test was done in qualitative variable. n=Total number of subjects, \*=Significant, \*\*=Highly significant, ns=Not significant

In case group mean days of weight gain started was 6.60±1.74 and it was 8.45±2.14 in control group. The mean (days) ± SD to regain birth weight was 10.35±3.09 and 13.50±3.70 in case and control group respectively (Table IV).

**Table IV***Comparison of weight gain pattern in two groups*

Variables	Case (K) (n=40)	Control (C) (n=40)	p value
Weight gain started (Days) (mean±SD)	6.60±1.74	8.45±2.14	0.001**
Birth weight regain (Days) (mean±SD)	10.35±3.09	13.50±3.70	0.001**

Data were expressed as Mean ± SD. Statistical analysis were done by Unpaired 't' test. \*\*=Highly significant

This table shows that mean weight gain (grams) of case group and control group were 18.35±7.81 and 13.55±4.89 respectively. Head circumference increase (cm/wk) 0.77±0.47 and 0.48±0.28 and length increase (cm/wk) 0.77±0.47 and 0.48±0.28 in case and control group respectively which were statistically significant (Table-V).

**Table V***Distribution of changes in rate of growth parameter between two groups at 40 weeks corrected ages*

Growth parameter	Case (K) (n=38)	Control (C) (n=37)	p value
Weight gain (gm/day) (mean±SD)	18.35±7.81	13.55±4.89	<0.001**
Head circumference increase (cm/wk) (mean±SD)	0.77±0.47	0.48±0.28	0.001**
Length increase (cm/wk) (mean±SD)	0.99±0.70	0.71±0.44	0.035*

Data were expressed as Mean ± SD. Statistical analysis were done by Unpaired 't' test. \*=Significant, \*\*=Highly significant, ns=Not significant

22 babies in KMC care were discharged within 14 days of admission and 16 patients after 15 days of admission. In conventional method care 7 patients were discharged within 14 days and 30 patients after 15 days of admission which was statistically significant (Table-VI).

**Table VI***Distribution of the patients by outcome on hospital stay and mortality*

Outcome	Case (K) (n=40) No. (%)	Control (C) (n=40) No. (%)	p value
Improved and discharge	38(95.0)	37(92.5)	0.644 <sup>ns</sup>
Death	2(5)	3(7.5)	
Hospital stay			
14 days	22(57.89)	7(18.9.0)	<0.001**
≥15 days	16(42.11)	30(81.0)	

Statistical analysis were done by  $\chi^2$  test. \*=Significant, \*\*=Highly significant, ns=Not significant

## Discussion

Four million newborn die each year in the world, among them 99% are from developing countries. Twenty eight percent of newborn deaths are attributed to low birth weight (LBW) and



prematurity.<sup>8</sup> Low birth weight (LBW) infants particularly for those weighing <2000 gm at birth are the major issues of concern in child and maternal care services.<sup>7</sup> As the conventional care for low birth weight babies in hospital are very costly procedure for developing countries KMC can be an alternative care for low-birth-weight infants. So to evaluate the efficacy of KMC for management of preterm low birth weight neonate a randomized controlled trial was conducted in neonatal ward of Dhaka Shishu (Children) Hospital. Neonates in both groups were found to be non-comparable in birth weight, sex, mode, place of delivery.

Incidence of hypothermia was less in KMC than conventional care group. During the hospital stay 25% neonates in KMC group became hypothermic and in conventional care group 40% became hypothermic which was not statistically significant ( $p=0.152$ ). This finding was comparable with a study done in Australia by Kathryn L. Roberts et al, where temperatures remained stable or rose by  $0.2^{\circ} - 0.4^{\circ}\text{F}$  ( $0.1^{\circ}-0.2^{\circ}\text{C}$ ) for both groups.<sup>9</sup> A study had done at Nepal found that 3.1 % babies in KMC group and 12.6% babies in control group developed hypothermia ( $p<0.0481$ ) which was statistically significant.<sup>10</sup> Fluctuation of temperature is more common in incubator care which is more detrimental for babies. Hypothermia were found more often in conventional care group than kangaroo mother care group (47% vs 27%), and  $p=0.05$  and this randomized control trial was done in Indonesia.<sup>11</sup> Sumon Rao et al<sup>12</sup> also had found significantly higher number of babies in incubator care group suffered from hypothermia.

A large portion of neonates (65%) in conventional care group developed sepsis during the study period. In KMC group, the rate of sepsis was 35%. The difference in rate of sepsis in two groups were statistically significant ( $p=0.007$ ). Charpak et al<sup>13</sup> found that the frequency of nosocomial infections was significantly higher in the control group (6.8%; KMC: 3.4%; rate ratio: 2.01; 95%CI: 1.04-3.87).

A metaanalysis showed KMC decreased risk of neonatal sepsis (RR 0.53, 95% CI 0.34, 0.83).<sup>14</sup> Cochrane review by Conde-A A, concluded that KMC reduces the incidence of sepsis.<sup>15</sup> It can be said that in KMC care incidence of sepsis is less as there is minimum handling by mother or by caregiver.

Apnoea occurred in 10(25%) neonates in KMC group and 14(35%) neonates in Conventional method care group which was not statistically significant. Similar result was found in Nepal where none of the baby developed apnoea in KMC and 3 babies developed apnoea in conventional care group which was not statistically significant ( $p=0.08$ ).<sup>10</sup>

This study had shown that first feed could start in 50% of babies in both the groups by 2-3 days which was not statistically significant ( $p= 0.16$ ). Similar result found in another study done in Pakistan regarding the starting of feeding between KMC and CMC.<sup>16</sup>

In this study mean days to reach full enteral feed was  $9.35\pm 3.95$  and  $14.35\pm 6.06$  days in KMC group and conventional care group respectively and this difference is statistically significant ( $p= 0.001$ ). Rao et al<sup>12</sup> had found less time required to reach full enteral feeding in KMC group ( $5.71\pm 5.65$  and  $4.85\pm 4.94$  in KMC and conventional care group respectively but the result was not statistically significant ( $p= 0.25$ ).

During discharge exclusive breast feeding rate was 95% for KMC and 60% conventional care which is statistically significant ( $p=0 .001$ ). Another comparative study by Sumon Rao where he also had found higher rate of exclusive breast feeding in KMC group.<sup>12</sup> Similar study had done in Pakistan, Iran and result were similar to us.<sup>15-17</sup>

In this study, KMC had shown significant effect on weight gain and regaining birth weight. In KMC group mean  $6.60\pm 1.74$  days was required to start weight gain and  $8.45\pm 2.14$  days for control group. To regain birth weight it was needed  $10.35 \pm 3.09$  and  $13.40\pm 3.70$  days in KMC group and conventional care group respectively and both the differences were significant statistically. A study had done in Indonesia and found median duration of birth weight regain was 5 days in KMC group and 6 days in CMC group and  $p= 0.4$  which was statistically not significant.<sup>11</sup> In another study the mean postnatal age at which the babies regained their birth weight was significantly less in the KMC group,  $15.7\pm 6.07$  days, compared to the control group,  $24.6 \pm 3.8$  days ( $p =0.001$ ) like our study.<sup>18</sup>

In this study at 40 weeks of corrected gestational age, KMC neonates showed significantly higher daily weight gain than conventional care group. In KMC

group rate of weight was  $18.35 \pm 7.81$  gms and in conventional care group  $13.55 \pm 4.89$  gms,  $p < 0.001$ , which is statistically significant. Head circumference increased (cm/wk)  $0.77 \pm 0.47$  and  $0.48 \pm 0.28$  and length gain (cm/wk) was  $0.99 \pm 0.70$  and  $0.71 \pm 0.44$  in KMC group and conventional care group respectively and both the differences were significant statistically. Gathwala et al had done a comparative study and result showed similar to us that were mean weight gain in the KMC group was  $21.92 \pm 1.44$  compared to  $18.61 \pm 1.28$  gm/day in the control group ( $p = 0.05$ ). The mean length gain in cm/week was  $1.03 \pm 0.5$  in the KMC group compared to  $0.74 \pm 0.05$  in the control group ( $p = 0.05$ ). The mean OFC increase in cm/week was  $0.59 \pm 0.04$  in the KMC group compared to  $0.47 \pm 0.03$  in the control group ( $p < 0.05$ ).<sup>19</sup> Similarly in another study had done by Sumon Rao and found that KMC babies achieved significantly better growth. It revealed that KMC babies had better average weight gain per day (KMC 23.99 gm vs CMC 15.58 gm,  $p < 0.0001$ ). The weekly increment in head circumference (KMC: 0.75 cm vs CMC 0.49 cm,  $p < 0.02$ ) and length (KMC: 0.75 cm vs CMC 0.49 cm,  $p < 0.02$ ) were higher in KMC group.<sup>12</sup>

During hospital admission mean weight was 1426 gms in KMC group and 1427 gms in conventional method care group having no statistical significance. But at 40 weeks of corrected age weight was 2105 gms in KMC group and 1946 gm in conventional method care. Achieving a better early growth pattern in neonates of KMC due to the reduced energy expenditure during KMC.<sup>20</sup>

As regards to hospital stay, kangaroo mother care reduced hospital stay significantly. Fifty seven percent neonates discharged within 14 days of hospital stay in KMC group, in case of conventional care group 18.9% of neonates discharged within 14 days but 80% of neonates need  $> 5$  days for discharge and p value is 0.001 which is statistically significant. Early attainment of full enteral feeding, fewer infection episodes possibly contributed to shorter hospital stay in KMC group. Mishra et al<sup>21</sup> showed, average duration of hospital stay was longer in CMC (14-18 days) than the KMC group (6-8 days) ( $p = 0.038$ ). Like our study in Ethiopia Ninety-one per cent and 88 per cent of babies in KMC and CMC were discharged from the study in the first 7 days of life, respectively.<sup>22</sup>

## Conclusion

This study conclude that KMC has found significantly effective in weight gain, exclusive breast feeding, reduction of infection and reduction of hospital stay. Thermoregulation control was better in KMC than CMC though it was not statistically significant.

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