

Randomized Control Trial of Kangaroo Mother Care in Low Birth Weight Babies at a Tertiary Level Hospital

Acharya N¹, Singh RR², Bhatta NK³, Poudel P⁴

Abstract

Introduction: This study was conducted to compare the effect of Kangaroo Mother Care (KMC) and conventional methods of care on weight gain, occurrence of hypothermia and apnea and duration of hospital stay among Low Birth Weight (LBW) babies. **Materials and Methods:** It was a randomized control trial conducted at a tertiary level hospital for a period of one year from June 2009 to May 2010. Total 126 stable LBW babies weighing less than 2000 gm and fulfilling inclusion criteria were included in the study. Neonates enrolled for the study were allocated to either KMC or control group using random number table. KMC group was subjected to Kangaroo mother care of at least six hours per day in not more than four sittings. In control group, babies were adequately clothed, covered and kept with their mother and if required were kept under radiant warmer. Recording of temperature in KMC group was done before, during and after KMC. In control group temperature was taken every 4 hours. Weighing of baby was done twice daily on electronic weighing scale. **Results:** Median daily weight gain (IQR) was 10 (6- 20) gm in KMC group as compared to 7 (0-10) gm in control group ($p<0.001$). Mean weight gain was 12.11 ± 9.04 gm in KMC group as compared to 3.29 ± 15.81 gm in control group ($p<0.001$). Incidence of hypothermia was more in control group (12.6%) as compared to KMC group (3.1%) ($p=0.048$). Duration of hospital stay was less in control group as compared to KMC group ($p=0.015$). **Conclusion:** LBW babies less than 2000 gm who receive KMC show better weight gain and have less incidence of hypothermia than those who do not receive KMC.

Key words: Kangaroo Mother Care (KMC), Low Birth Weight (LBW), Hypothermia

Introduction

Low Birth Weight (LBW) is defined as birth weight of less than 2500 grams irrespective of gestational age. It is one of the major health problems in developing countries. World-wide, twenty-five million LBW infants are born each year, the great majority (96%) of them in developing countries and it constitutes as much as 30% of births in South Asian countries^{1, 2}. A survey conducted in 4 regional hospitals in Nepal in 1999 showed that 20.4 to 34.7 percent of the babies are born with low birth weight³. According to Nepal demographic and health survey (NDHS) 2006, the incidence of LBW is 14%⁴.

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In Nepal infant and neonatal mortality and morbidity is very high: Infant mortality rate is 48 per 1000 live births. Neonatal mortality rate is 33 per 1000 live births and perinatal mortality rate is 45 per 1000 births⁴. It is estimated that in Nepal nearly 50,000 children under one year of age die every year. Two third of them die within 28 days of age, resulting in over 30,000 neonatal deaths per year. Among those dying within the neonatal period, 20,000 (two third) die in the first week of life. Among those dying within the first week of life, more than 16,000 die within the first 24 hours. As things stand, this means that three to four

newborns are dying every hour in Nepal⁵. When babies are small or very small sized at birth, they have higher chance of mortality⁴. Hypothermia is one of the major underlying contributors to morbidity in LBW infants and predisposes them to infection and mortality during both the neonatal period and infancy². In industrialized countries, there are sufficient basic equipments like incubators and radiant warmers and good financial resources for highly sophisticated neonatal care. They have well equipped nurseries with adequate trained skilled manpower⁶. But in our part, there is lack of equipments like warmers and incubators. Incubators and other equipments, for instance, where available, are often insufficient to meet local needs. Purchase of the equipment and spare parts, maintenance and repairs are difficult and costly; the power supply is intermittent, so the equipments do not work properly. Under such circumstances good care of preterm and LBW babies is difficult. Hypothermia is frequent, aggravating the poor outcomes due to prematurity^{6,7,8}.

Kangaroo mother care (KMC) is humane, low cost technique for care of preterm low birth weight infants which can be started early and can be easily done both in hospital and even at home after the discharge of the baby^{6,7}. It is a powerful, easy-to-use method to promote the health and well-being of infants born preterm and LBW⁷. During KMC, mothers function somewhat like human incubators, providing physiological homeostasis, appropriate stimulation, and the main source of nutrition. Basic physiological variables such as temperature, oxygenation and heart rate are maintained within clinically acceptable limits in the kangaroo position¹².

Materials and Methods

Design and study population: This was a randomized control trial conducted in newborn nursery BPKIHS Dharan for a period of one year from June 2009 to May 2010.

Inclusion and Exclusion criteria: Inclusion criteria were LBW babies with birth weight <2000 gm admitted in new born Nursery. Exclusion criteria were critically ill babies requiring ventilatory or inotropic support or radiant warmer, babies with chromosomal and life threatening congenital anomalies, babies whose mothers are critically ill and babies whose mothers do not consent for study

Randomization and intervention: Total 126 neonates who fulfilled the above mentioned inclusion criteria were included in the study. Neonates enrolled for the study were allocated to either KMC group or

control group by using a random number table. Before starting Kangaroo Mother Care, the method of care and its benefits were explained to participating mothers and at least one other family member. Mothers and staffs were also informed and asked to look for dangers signs such as apnea, cyanosis during KMC so that action could be taken immediately. Once both baby and mother were ready, the KMC group was subjected to Kangaroo mother care of at least 6 hours per day in not more than 4 sittings, each sitting of at least 1 hour. During Kangaroo care, mother wore a loose blouse and the baby was held upright between the breasts and the limbs were flexed and the head was turned to one side not much flexed or extended. Babies wore only diaper and a cap during the period of KMC. The blouse covered the infant's trunk and extremities but not the head. The baby was further supported by 3 meters long flannel clothes which was wrapped around mother's chest from outside her blouse. Then mother was seated in a comfortable position. The mother was encouraged to hold her baby in this position for at least 1 hour. If the baby passed urine and/or stool during the procedure and she felt discomfort she was asked to change the diaper and continue KMC. Just before starting KMC, baby was breast fed or tube fed; no feeding was given during KMC. When babies were not in KMC, they were adequately clothed and kept covered. The mothers were provided KMC chart to keep the records of duration of KMC. In control group babies were adequately clothed, covered and kept with their mother. If babies in control group did not maintain temperature, they were kept under radiant warmer.

Anthropometry: Weighing of baby was done twice a day before feeding on an electronic weighting scale (seca 374) with sensitivity of 10 gms. Length was taken at admission and at the time of discharge with infantometer. Head circumference was measured at admission and at discharge with a non stretchable tape.

Monitoring: Recording of temperature of baby in kangaroo group was done before, during and after KMC with a thermometer kept in axilla for 5 minutes. When not in KMC, temperature was taken every 4 hours. Axillary temperature in control group was taken every 4 hours. Babies requiring phototherapy were temporarily withdrawn from KMC group and later included when off phototherapy. All details of the delivery were recorded in proforma. Modes of delivery, birth weight, APGAR score, gestational age, date of admission, weight at starting of KMC, mother's information (name, age, gravida/parity), were taken from neonatal problem sheet. Gestational age assessed

by the modified Ballard’s score that was done within 24 hours was also noted from the problem sheet. Babies were monitored for apnea, sepsis, hyperbilirubinemia, serious illness, feeding, weight gain and duration of stay in hospital.

Outcome assessment: Primary outcomes; Average weight gain, Occurrence of hypothermia and Occurrence of apnoea. *Secondary outcome;* Duration of hospital stay.

Data Analysis: Data was recorded on a pre designed performa. Collected data was entered in MS Excel sheet. Subsequently data was analysed using SPSS statistical software (version 17). Appropriate tests of significance were applied accordingly.

Results

Interpretation: Table 1 displays baseline neonatal characteristics in two groups. All characteristics were comparable between 2 groups except weight at enrollment which was higher in control group. In multivariate analysis weight at enrollment was comparable between two groups ($p= 0.106$).

Median daily weight gain (IQR) was 10 (6-20) gm in KMC group as compared to 7 (0-10) gm in the control group which is highly significant ($p<0.001$). Mean weight gain was 12.11 ± 9.04 gm in KMC group

as compared to 3.29 ± 15.81 gm in the control group which is also highly significant ($p<0.001$). In KMC group 3.1% babies and in the control group 12.6% babies developed hypothermia during the study period which is statistically significant ($p=0.048$). Duration of hospital stay was less in the control group as compared to KMC group ($p=0.015$). This is also statistically significant. Average increase in length and head circumference was comparable in both groups.

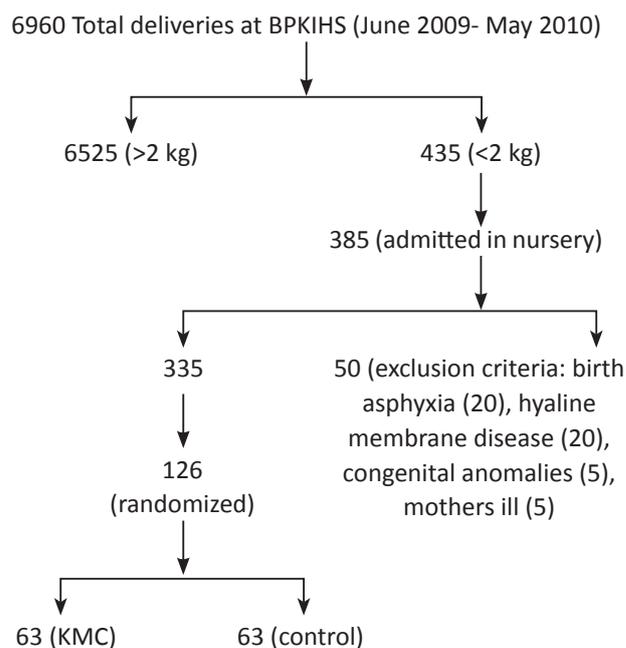


Table 1: Baseline neonatal characteristics

Characteristics	KMC	Control	p-value
Male sex n (%)	40 (63.4)	46 (73.0)	0.251
Birth weight (gm) M±SD	1385.87±234.12	1458.57±172.66	0.050
GA (wks) Mean±SD	32.22±2.4	32.54±1.87	0.409
Inborn n (%)	46 (73.01)	50 (79.3)	0.403
Active resuscitation at birth n (%)	3 (4.76)	0 (0)	0.244
Weight at enrollment (gm) M±SD	1362.3±240.14	1451.51±174.91	0.02*
VLBW n (%)	49 (77.7)	47 (74.6)	0.676
Length at enrollment (cm) M±SD	40.13±3.09	39.75±2.74	0.457
Head circumference at enrollment (cm) M±SD	28.17±1.69	27.94±1.46	0.427

n-number, M-mean,SD-Standard deviation, gm-gram, cm-centimetre, GA-gestational age, *-statistically significant

Table 2: Baseline maternal characteristics

Characteristics	KMC	Control	p-value
Education below 10 th grade n (%)	51 (81.0%)	55 (87.3%)	0.329
Parity (M±SD)	1.73±1.27	1.56±0.84	0.365
Maternal weight kg (M±SD)	49.9±5.47	48.6±4.05	0.132
LSCS delivery (n %)	2 (3.17)	0 (0)	0.496
Maternal age yrs (M±SD)	23.76±3.93	23.27±3.33	0.450

n-number, M-mean, SD-Standard deviation, kg-kilogram Interpretation: Table 2 shows baseline maternal characteristics in two groups. All characteristics were comparable between two groups

Table 3: Analysis of outcome

Variables	KMC	Control	p-value
Weight gain/day (gm) Median (IQR)	10 (6-20)	7 (0-10)	<0.001*
Occurrence of hypothermia	2	8	0.048*
Occurrence of apnea	0	3	0.080
Average duration of hospital stay (days)M±SD	16.13±5.84	13.14±7.62	0.015*
Average increase in length cm/week M±SD	0.386±0.34	0.343±0.29	0.460
Average increase in head circumference cm/week M±SD	0.310±0.26	0.287±0.27	0.627

IQR=Interquartile range, n- number, gm-gram, cm-centimetre, M-mean, SD-standard deviation, *-statistically significant

Discussion

There are different methods and equipments used to prevent hypothermia in newborn babies. Kangaroo Mother Care is one of the methods which can be applied in thermal protection of the LBW babies. It provides effective thermal control with reduced risk of hypothermia in stable babies. KMC is at least equivalent to conventional care with incubators in terms of safety and thermal protection. There are considerable numbers of LBW babies being delivered and taken care of in the Neonatal unit of BPKIHS. Data from BPKIHS shows that the incidence of LBW babies was 19% from June 2009 to May 2010.

This randomized control trial conducted at the Pediatric Nursery BPKIHS Dharan over a period of one year from June 2009 to May 2010 compares the effect of KMC and conventional methods of keeping the baby warm and their effect on weight gain, duration of hospital stay and occurrence of hypothermia and apnoea in low birth weight babies.

In this study babies were from various districts of eastern region and few from neighboring places of India thus covering large geographic area. In both the groups, baseline neonatal characteristics were comparable except weight at enrollment which was higher in control group. This difference occurred despite careful randomization. To eliminate possible confounding of final result by this difference, multivariate analysis was done in this study.

Two variables where P value was <0.20 (birth weight and weight at enrollment) in univariate analysis were analysed again. In multivariate analysis, it was found that both variables were not significant (P 0.373, P 0.106). So we can conclude that in randomization univariate analysis is significant because of chance only.

Mean daily weight gain of babies in KMC group was 12.11±9.04 gm. Median daily weight gain was 10

(6-20) gm in KMC babies. In control group mean daily weight gain of babies was 3.29±15.81 gm. Median daily weight gain was 7 (0-10) gm in control. Both the results are statistically significant ($p<0.001$) which shows that babies receiving KMC show better weight gain as compared to those receiving conventional method of care (CMC).

This finding is comparable with study done by Rao et al which showed that KMC babies had better average weight gain per day (KMC: 23.99 gm vs CMC 15.58 gm $p<0.0001$)¹⁴.

It was also comparable with study by Ramanathan et al which showed that neonates in the KMC group demonstrated better weight gain after the first week of life (15.9±4.5 gm/day and 10.6±4.5 gm/day in the KMC group and control group respectively, $p<0.05$)¹⁵. Another study done in Ethiopia by Cattaneo A et al showed that KMC babies had higher mean daily weight gain (21.3 gm vs 17.7 gm)¹⁶.

Cochrane review done by Conde-Agudelo et al showed KMC infants had gained more weight per day by discharge (weighed mean difference 3.6 g/day, 95% confidence interval 0.8-6.4)¹³. Another study done at Maternity hospital, Thapathali, Kathmandu by Subedi et al showed that babies had good weight gain of average 30.35 gm /day after giving KMC¹⁷. Various studies showed that KMC is helpful in preventing hypothermia in LBW babies (Kadam et al, Rao et al, Cattaneo et al). We also attempted to compare occurrence of hypothermia in two groups. We found that 3.1% babies in KMC group and 12.6% babies in control developed hypothermia during the study period ($p=0.0481$) which is statistically significant. Study done in Mumbai by Kadam et al showed that there was significant reduction in KMC versus CMC group of hypothermia (10/44 versus 21/45 $p<0.01$)¹⁰. Study done by Rao et al showed that hypothermia was less in KMC as compared to CMC (5.9 versus 36.9%)¹⁴.

In a RCT done by Cattaneo A et al in 3 tertiary teaching hospitals showed that hypothermia was significantly less common in KMC infants in Meridia, Mexico (13.5 vs 31.5 episode/100infants/d) and overall (10.8 vs 14.6)¹⁶. Prospective study done in Chandigarh by Veena Rani et al showed that no episode of hypothermia was observed during KMC¹⁸.

A study done in Nigeria by O.E. Ibe et.al showed that the risk of hypothermia was reduced by 90% when nursed by KMC rather than conventional care, relative risk (RR) 0.09⁸. In our study it was found that no babies in KMC group developed apnoea but in control group 3 babies developed apnoea requiring. Although there is occurrence of apnoea in control group, the result is not statistically significant ($p=0.080$). It was similar to study done by Kadam et al who showed that incidence of apnoea is similar in both groups KMC and control¹⁵. It was comparable with the prospective observational study done by Subedi K et al which showed that babies given KMC had less morbidity like apnoea¹⁷. Prospective study done by Veena Rani et al showed that no episode of apnoea was observed during KMC¹⁸.

Various studies showed that KMC shortens hospital stay in LBW babies (Rao et.al, Cattaneo et.al). In contrast to those studies, in our study average duration of hospital stay was longer in KMC than control, 16.13 ± 5.8 days in KMC and 13.14 ± 7.6 days in control ($p= 0.015$). In KMC group weight at enrollment was less (1362.3 ± 240.14 gm) as compared to control group (1415 ± 174.91 gm) but it was not statistically significant in multivariate analysis. Longer hospital stay in KMC group may be because of our criteria for discharge in LBW babies which is weight of more than 1.6 kg at discharge.

Study done by Ramnathan et.al showed that there was earlier hospital discharge in KMC (27.2 ± 7 versus 34.6 ± 7 days in KMC and control group respectively)¹⁵. Another study done by Cattaneo et al showed that KMC infants were discharged earlier as compared to control (13.4 versus 16.3 days after enrollment)¹⁶. In a study done by Rao et.al duration of hospital stay was similar in both groups (12.78 ± 6.2 days in KMC and 12.86 ± 5.7 days in control ($P 0.93$) which showed that KMC has no effect on duration of hospital stay¹⁴.

A study done at Rohtak, India by Geeta et al showed that the duration of hospital stay was significantly shorter in the KMC group (3.56 ± 0.57 days) compared to control group (6.80 ± 1.30 days)¹¹. Among KMC group 23 babies (36.5%) developed neonatal hyperbilirubinemia requiring phototherapy. They were

temporarily withdrawn from KMC and again included when off phototherapy.

No mortality occurred in both the groups because sick babies were excluded from the study at beginning.

Conclusions

LBW babies weighing less than 2000 gm who receive KMC show better weight gain than those who do not receive KMC and the incidence of hypothermia in LBW babies weighing less than 2000 gm who receive KMC is less than those who do not receive KMC.

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Conflict of Interest: This article is based on the final thesis (part of compulsory thesis submission) report submitted to Department of Paediatrics and Adolescent Medicine, BP Koirala Institute of Health Sciences, Dharan.

Permission from IRB: Yes.

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