Original Article

Postnatal Kangaroo mother care practice at home and comparison of improvement in vital parameters in low-birth-weight babies in-home setup and non-teaching hospital setup in rural coal mines area Jharkhand, India: A community-based observational study

Tulsi Prasad, Ashish K. Roy

Department of Pediatrics and Neonatology, Tata Central Hospital, West Bokaro, Jharkhand, India

Abstract

Introduction: Low birth weight (LBW) newborns especially those <2000 g are more prone to hypothermia due to which other physiological parameters gets deteriorated in the 1st week of life. The objective of this observational study was to continue Kangaroo mother care practice at home and to ascertain whether KMC was effective in improving the vital parameters of LBW babies when it is given at home in a rural coal mines area, in Jharkhand, India. **Materials and Methods:** This study was a community-based prospective observational study, done over three years from November 2019 to November 2022. In this study, we included 156 pairs of both mothers and LBW babies (weight 1500 g to <2000 g). After discharge from the hospital on day 3, KMC was continued at home on day 4, day 5, and day 6. Data of four physiological parameters, namely, temperature, oxygen saturation, respiratory rate, and heart rate were collected before and after KMC and analyzed. **Results:** Among 400 newborns, 156 LBW babies (39.0%) who were given KMC at home showed similar but statistically significant improvement of vital parameters, especially in temperature and oxygen saturation ($P < 0.0001$) compared to the same babies 156 (39.0%) given KMC in the hospital ($P < 0.001$). **Conclusion:** Kangaroo mother care, which was continued at home, has a significant role in the Improvement of vital parameters, especially concerning temperature and oxygen saturation. If the babies in the weight range of 1500 g to <2000 g are healthy, well-breast-fed, and have no other risk factors, they can be discharged early and managed at home by delivering supportive care and nursing care along with Kangaroo mother care with continuous follow-up.

Keywords: Community-based, Kangaroo mother care, low birth weight, physiological parameters, secondary care hospital

Introduction

Prematurity and low birth weight (LBW) are key drivers and prime causes of neonatal mortality, especially in developing countries.[1,2] According to a recent study, 20.5 million low-birth-weight newborns are delivered every year in the entire world; the great majority of them (96.5%) are in low- and middle-income countries.[3,4] Each year approximately eight million LBW infants are delivered in India, which emphasizes almost 40% of the worldwide plummet.[5] LBW babies are at greater risk of complication and death because their ability to control their body temperature is weak, that is, they get cold or

Address for correspondence: Dr. Tulsi Prasad, Department of Pediatrics and Neonatology, Tata Central Hospital, West Bokaro - 825 314, Jharkhand, India.
E-mail: tulsiranchi@gmail.com

Received: 02-03-2023 **Revised:** 25-06-2023
Accepted: 26-06-2023 **Published:** 30-09-2023

Access this article online

Quick Response Code:

Website: http://journals.lww.com/JFMPC

DOI: 10.4103/jfmpc.jfmpc_407_23

How to cite this article: Prasad T, Roy AK. Postnatal Kangaroo mother care practice at home and comparison of improvement in vital parameters in low-birth-weight babies in-home setup and non-teaching hospital setup in rural coal mines area Jharkhand, India: A community-based observational study. J Family Med Prim Care 2023;12:2103-9.

hypothermic very quickly.[6] Hypothermic newborns stop feeding and there is a deterioration of other physiological parameters like temperature, oxygen saturation, heart rate, and respiratory rate.[7] A recently published report has shown that 2.9% of intramural and 45% of extramural babies are developed moderate to severe types of hypothermia, especially in a resource-limited setting.[8] Kangaroo mother care, skin-to-skin contact with mother and baby has emerged as a boon for these localities.[9] It is a non-conventional low-cost method for newborns that provides warmth, touch, and security to the LBW.[10] It reduces the complications and overall mortality, early discharge from the hospital, increases the confidence and self-esteem in the mother, and bondage between mother and baby.[11] However, KMC needs to be taught to the mother by a motivated team, and for better effectiveness, its effects need to be demonstrated to the mother by caregivers.[12] Our hospital is situated in a rural coal mines community, and the population of this area is economically very weak. Due to the high number of Covid-19 cases during our study period, mothers and relatives did not want to stay in the hospital. Therefore, we planned to continue KMC at home to save such types of LBW newborns. KMC was initiated in the hospital and continued at home until the infant needs it, and for optimum care, a regular follow-up was ensured.[13,14]

This observational study aims to continue Kangaroo mother care practice at home and to ascertain whether KMC was effective in improving the vital parameters of LBW babies when it is given at home in a rural coal mines community, in Jharkhand, India.

The final result is beneficial for primary health care physicians to promote and encourage the KMC practice of LBW babies after visiting their homes and collaborating with family members, especially in resource-limited areas.

Materials and Methods

Tata Central Hospital, West Bokaro a 60 bedded multispecialty secondary- care with up to level 1 NICU facility, situated in a rural coal mines area in Ramgarh district of Jharkhand, India. This hospital caters to the local population of the rural and suburban areas and more than 40 villages are sitting around the hospital.

Study design

This was a community-based prospective observational study.

Study setting

This study was carried out in the pediatrics and neonatal department of Tata Central Hospital. This study was also carried out at the residence of mothers or attendees situated 10–15 kilometers encompassing the hospital.

Study period

The study commenced in November 2019 and was completed in November 2022. This study took three years to complete.

Ethical clearance

Before the initiation of the study ethical approval was obtained from the hospital's ethics committee No. WBD/HA MED/49/1329/2019, dated November 14, 2019. After the training and motivational session, written informed consent was taken from all participant mothers.

Inclusion and exclusion criteria

Babies weighing 1500 g to <2000 g, well fed, and whose vitals were stable were included and babies weighing <1500 g and >2000 g, delivered with severe diseases, with gross congenital malformation, and whose mother refused to give consent even after repeated training and counseling were excluded from our study.

Among 400 LBW delivered during our study period, 244 (61.0%) were excluded because 25 (10.24%) LBW had severe sepsis with congenital abnormalities, 12 (4.91%) LBW had severe meconium aspiration syndrome with asphyxia, 14 (5.73%) LBW had severe respiratory distress, weight of 9 (3.68%) LBW newborns were <1500 g, mothers and relatives of 15 (6.14%) LBW newborns refused to give KMC, mothers of 6 (2.45%) LBW had major medical or mental illness, and weight of 163 (66.80%) newborns were >2000 g. We included 156 (39.0%) pairs of both mothers and inborn LBW babies (weight 1500 g to <2000 g), and babies were divided into two groups, Group A which was given KMC in the hospital (n = 156) on day 1, day 2, and day 3 and Group B in which the same babies were given KMC at home (n = 156) on day 4, day 5, and day 6.

Methodology

We formed a group of sisters, paramedical staff, and pediatricians for the successful completion of this study. This group consisted of six nursing staff, four paramedical staff, and two pediatricians working in the pediatrics, maternity, and neonatal ward. Our highly trained and experienced paramedical staff, nurses, and pediatricians arranged training sessions about KMC, breastfeeding, and their benefits for every mother and their family members.

After resuscitation of the delivered baby, we used to put the baby on the mother's bare chest (abdomen) for skin-to-skin contact. After stabilization of the newborn and mother, KMC was given for a fixed time duration of 60 minutes, 120 minutes, and 180 minutes for the 1st, 2nd, and 3rd day in the hospital, respectively (Group A). After discharging the mother and newborn on the 3rd day, the same baby was given KMC for a fixed time duration of 60 minutes, 120 minutes, and 180 minutes for the 4th, 5th, and 6th day at home, respectively (Group B). Our trained nurses, paramedical staff, and pediatrician used to visit home for assisting and providing KMC.

Data collection

A register (logbook) was used to collect data for four basic physiological parameters like temperature, oxygen saturation,

heart rate, and respiratory rate before and after KMC in the hospital on day 1, day 2, day 3, and at home on day 4, day 5, and day 6, respectively. After collecting the data, we embedded it into a predesigned Proforma in Microsoft Excel 2010 sheet. Data was collected by simple and easily available instruments from the hospital and home. The temperature was recorded (F°) by a simple digital thermometer by keeping it in the axilla. Respiratory rate (per minute) was measured by looking at chest movements. Heart rate (beat/minute) was recorded by using a pediatrics stethoscope, and oxygen saturation (%) was recorded with the help of a pulse oximetry by keeping it on a finger (thumb or big toe).

Statistical analysis

Data were collected using MS Excel. All tests were two-sided and a P value < 0.05 was significant. The analysis was done using SPSS, Chicago, IL USA Version 21.0. Data have been summarized by Mean (SD) ranges. All four physiological variables were non-normally distributed. Mean values of before and after KMC in hospital care and home care separately were compared by using the Wilcoxon sign rank test. Similarly, the average parameters before KMC and after KMC concerning home care and hospital care were also assessed by using Wilcoxon signed rank test and found to be significant which means the KMC at-home setup was similar but statistically significant.

Results

There were 400 LBW newborns delivered in our hospital within our study period; among those 244 (61.0%) newborns were excluded as they couldn't fulfil our selection criteria. We included data of four physiological parameters from 156 (39.0%) LBW newborns for the hospital KMC setting on the 1st, 2nd, and 3rd day and after discharge from the hospital, the data was repeated for the same baby during KMC session at home on the 4th, 5th, and 6th day, respectively. We didn't include less than 1500 g LBW in our study as our hospital does not have a tertiary care facility. Characteristics of LBW babies as a form of gestational age in weeks, birth weight in grams, gender, and mode of delivery are shown in Table 1.

Table 1: Characteristics of LBW babies

Total LBW delivered within the study period		
400	Excluded	244
	Total Study Group	156
Characteristics of LBW babies	**Total study group in Group A and Group B (*n*=156)**	
	No.	**%**
1. Gestational Age (Weeks)		
31–31.5	96	61.53
32–32.5	52	33.33
33	8	5.12
2. Birth weight (Grams)		
1500–1600	96	61.53
1700–1800	52	33.33
1900	8	5.12
3. Gender		
Male	66	42.30
Female	90	57.69
4. Mode of delivery		
Normal	69	44.23
LSCS	87	55.76

LBW=Low birth weight, LSCS=Lower segment caesarean section

Comparison in temperature

During KMC in the hospital (Group A), we observed that the mean temperature before KMC on day 1, day 2, and day 3 was 95.03, 95.60, and 96.19 and after KMC it was 95.68, 96.13, and 96.55, respectively ($P \leq 0.001$) as shown in [Table 2]. Whereas, during KMC at home (Group B), the mean temperature before KMC on day 4, day 5, and day 6 was 95.62, 95.94, and 96.29 and after KMC it was 97.66, 97.74, and 97.80 respectively ($P \leq 0.0001$) as shown in Table 3. There was a similar but statistically significant improvement in temperature in Group B.

Comparison in oxygen saturation

During KMC in the hospital (Group A), we observed that the mean oxygen saturation before KMC on day 1, day 2, and day 3 was 86.48, 90.71, and 90.77 and after KMC it was 89.64, 91.36, and 91.28, respectively ($P = 0.001$) as shown in Table 2. Whereas, during KMC at home (Group B), before KMC it was 86.69, 90.76, and 88.50 on day 4, day 5, and day 6, and after KMC it was 97.55, 96.47, and 97.17, respectively ($P = 0.0001$) as shown in Table 3. So, we analyzed that there was a similar but statistically significant improvement in oxygen saturation in Group B.

Comparison in heart rate

When we analyzed the stability in heart rate in Group A, we observed that the mean heart rate before KMC on day 1, day 2, and day 3, was 125.88, 132.69, and 136.23 and after KMC it was 126.86, 133.64, and 136.19, respectively. Whereas, in Group B before KMC mean heart rate was 130.93, 134.22, and 134.77 and after KMC it was 132.14, 134.10, and 135.40 on day 4, day 5, and day 6, respectively. So, it was observed that in Group A on days 1 and 2, KMC was statistically significant ($P \leq 0.001$) as shown in Table 2, while in Group B, only on day 1 it was significant ($P = 0.017$), and on day 2 and day 3 it was statistically nonsignificant ($P \geq 0.05$) as shown in Table 3.

Comparison in respiratory rate

When we analyzed the stability in the respiratory rate in Group A, we found that the mean respiratory rate after KMC on day 1 showed a slightly significant change whereas on day 2 and day 3, it did not show any changes as shown in Table 2. However, in Group B the mean respiratory rate after KMC on day 4, day 5, and day 6 did not find any significant changes as shown in Table 3.

So, during the overall comparison of average improvement of vital parameters, we found that Kangaroo mother care, which was given at home setup (Group B) has a similar but statistically significant contribution to improvement in vital parameters,

Table 2: Characteristics of four physiological parameters recorded during Kangaroo mother care in the hospital (Group A)

Physiological parameters (*n*=156)	Statistics	Day-1		Day-2		Day-3	
		Before KMC (*n*=156)	After KMC (*n*=156)	Before KMC (*n*=156)	After KMC (*n*=156)	Before KMC (*n*=156)	After KMC (*n*=156))
Temperature (F)	Mean (SD)	95.03 (0.91)	95.68 (0.64)	95.60 (0.59)	96.13 (0.52)	96.19 (0.42)	96.55 (0.58)
	Range (Min, Max)	3.6 (93.2, 96.8)	2.7 (94.2, 96.9)	3.0 (94.2, 97.2)	2.6 (94.9, 97.5)	2.7 (94.9, 97.6)	3.0 (95.2, 98.2)
	P	<0.001		<0.0001		<0.001	
O_2 Saturation	Mean (SD)	86.48 (5.16)	89.64 (2.93)	90.71 (2.37)	91.36 (2.24)	90.77 (2.09)	91.28 (2.05)
	Range (Min, Max)	23.0 (70.0, 93.0)	12.0 (82.0, 94.0)	12.0 (82.0, 94.0)	13.0 (83.0, 96.0)	9.0 (86.0, 95.0)	8.0 (88.0, 96.0)
	P	<0.0001		<0.001		<0.001	
Heart rate (BPM)	Mean (SD)	125.88 (9.14)	126.86 (6.98)	132.69 (8.03)	133.64 (6.56)	136.23 (7.59)	136.19 (5.95)
	Range (Min, Max)	48.0 (100.0, 148.0)	34.0 (110.0, 144.0)	48.0 (112.0, 160.0)	40.0 (114.0, 154.0)	44.0 (118.0, 162.0)	40.0 (120.0, 160.0)
	P	<0.001		<0.001		0.088	
Respiration rate (per minute)	Mean (SD)	32.06 (6.47)	36.85 (4.75)	38.78 (6.04)	38.56 (4.65)	41.02 (4.98)	41.67 (3.21)
	Range (Min, Max)	26.0 (24.0, 50.0)	20.0 (28.0, 48.0)	30.0 (28.0, 58.0)	22.0 (28.0, 50.0)	32.0 (28.0, 50.0)	16.0 (34.0, 50.0)
	P	<0.0001		0.061		0.071	

BPM=Beats per minute, F=Fahrenheit, KMC=Kangaroo mother care, SD=Standard deviation

Table 3: Characteristics of four physiological parameters recorded during Kangaroo mother care at home (Group B)

Physiological parameters (*n*=156)	Statistics	Day-4		Day-5		Day-6	
		Before KMC (*n*=156)	After KMC (*n*=156)	Before KMC (*n*=156)	After KMC (*n*=156)	Before KMC (*n*=156)	After KMC (*n*=156)
Temperature (F)	Mean (SD)	95.62 (0.66)	97.66 (0.40)	95.94 (0.54)	97.74 (0.44)	96.29 (0.50)	97.80 (0.55)
	Range (Min, Max)	3.6 (93.5, 97.1)	1.7 (96.8, 98.5)	2.5 (94.5, 97.0)	2.0 (96.5, 98.5)	2.2 (95.0, 97.2)	1.7 (96.8, 98.5)
	P	<0.0001		<0.0001		<0.0001	
O_2 Saturation	Mean (SD)	86.69 (3.57)	97.55 (1.23)	90.76 (2.95)	96.47 (1.37)	88.50 (2.82)	97.17 (1.42)
	Range (Min, Max)	16.0 (76.0, 92.0)	5.0 (94.0, 99.0)	17.0 (76.0, 93.0)	13.0 (86.0, 99.0)	16.0 (78.0, 94.0)	12.0 (87.0, 99.0)
	P	<0.0001		<0.0001		<0.0001	
Heart rate (BPM)	Mean (SD)	130.93 (9.76)	132.14 (6.82)	134.22 (8.50)	134.10 (7.22)	134.77 (8.49)	135.40 (6.05)
	Range (Min, Max)	58.0 (110.0, 168.0)	48.0 (112.0, 160.0)	44.0 (118.0, 170.0)	40.0 (115.0, 155.0)	50.0 (110.0, 160.0)	40.0 (118.0, 158.0)
	P	<0.017		0.618		0.100	
Respiration rate (per minute)	Mean (SD)	36.72 (6.14)	37.28 (4.75)	39.08 (5.66)	38.73 (4.42)	39.87 (5.99)	39.65 (4.87)
	Range (Min, Max)	36.0 (24.0, 60.0)	30.0 (28.0, 58.0)	30.0 (26.0, 56.0)	28.0 (28.0, 56.0)	32.0 (26.0, 58.0)	28.0 (28.0, 56.0)
	P	0.102		0.339		0.394	

BPM=Beats per minute, F=Fahrenheit, KMC=Kangaroo mother care, SD=Standard deviation

especially concerning temperature and oxygen saturation as shown in Table 4.

Discussion

In this observational study, we observed that there was a significant improvement in temperature in LBW babies when KMC was given at home ($P < 0.0001$). We could not find any study which was done at the residence of mothers or attendees (at home) and even in secondary care with level 1 NICU facility, coal mines hospital, especially in the Indian scenario. But we found similar types of studies done in tertiary care hospitals by Pramila Verma *et al.*[15] and they concluded that after KMC there was a mean rise in temperature from 96.69 ± 2.45°F to 98.07 ± 0.41°F which was statistically significant ($P \leq 0.001$). Ludington-hue *et al.*[16] observed in their randomized controlled trial study that after KMC mean temperature remained within a statistically significant and clinically acceptable range. Another study was done by Parmar VR *et al.*[17] in Chandigarh India, and they observed that after the KMC session, the body temperature rose from 97.02 ± 0.19°F to 98.93 ± 0.25°F, which was concurrent to our present study.

In our study, like the improvement in temperature, we found a statistically significant improvement in oxygen saturation at home (Group B). This sort of improvement in oxygen saturation was also observed in a quasi-experimental study, done with 100 LBW newborns by Parisa Parsa *et al.*[18] which was similar to our study. Similarly, Ranjan A *et.al.*[19] observed in their observational study that there was a significant improvement in oxygen saturation after KMC ($P < 0.001$), which is matching with our result.

In most of the studies, the stability in heart rate after KMC has been observed in a tertiary care center and they found significant stability in heart rate after 2nd hour of the KMC session. A comparative study randomized controlled trial was performed by Sahbaei Roy *et al.*[20] with 60 LBW newborn babies (1.5 to ≤2.0 kg) and found to have a statistically significant improvement in the heart rate after 2nd hour of the KMC session. Alpanamayi Bera *et al.*[21] reported that the heart rate significantly rises and the mean changes were statistically significant on all 3 days of the KMC session ($P < 0.05$).

In our study, we found statistically nonsignificant stability in respiratory rate after the KMC session in Group B when it was given on the 4th, 5th, and 6th days. But the statistically significant result was seen on day 1 and day 2 in Group A when KMC was given in the hospital. Kadam S *et al.*[22] had proven in their observation that there was significant stability in respiratory rates in babies weighing 1.5 to 2 kg (36.2 v/s 40.7 ($P < 0.05$).

No significant difference was found in improvement in heart rate and respiratory rate between Group A and Group B, but we observed similar but statistically significant improvement in temperature and oxygen saturation in Group B (at-home setup).

Statistically significant improvement in vital parameters at home setup might be due to family support (especially mums of KMC mothers), social and psychological support from family members, empowerment, getting a good environment of privacy, getting as much time as the mother wants for KMC, nutritious home-made food, and lastly, our effort to deliver consistent training, motivational speech and promoting mothers and family members about the KMC after visiting home during KMC session.[23,24]

The strength of this study is that it is one of the observational studies that was done in the community and a level 2, coal mines hospital, especially in a rural area in the Indian scenario. New intimation, instruction (training), and demonstration on KMC can be imparted by our primary health professionals and family physicians by using the final result, especially in rural localities.

However, in this study, there were some limitations. The major limitation of this study was the comparison of vital parameters at home setup and in the hospital setup on different days. The vital parameters of a newborn would be different on day 1 compared to day 4 due to transition physiology. It was a community-based prospective observational study rather than a randomized controlled trial. Even after continuous counseling and training sessions, KMC could not be given correctly and hence such mothers had to be excluded from our study. This study was conducted in a single secondary care hospital and single community setting giving rise to Berrkisonian bias. Our sample size was small, and therefore this type of study needs more sample sizes for better analysis and results.

Table 4: Comparison of improvement in an average of four vital parameters in hospital setup and at-home setup separately concerning before KMC and after KMC

Physiological parameters (n=156)	Statistics	BKMC		AKMC	
		Hospital	Home	Hospital	Home
Avg. Temperature (F)	Mean (SD)	95.57 (0.52)	95.95 (0.42)	96.22 (0.46)	97.73 (0.42)
	P	<0.0001		<0.0001	
Avg. O_2 Saturation	Mean (SD)	88.98 (2.44)	87.64 (2.29)	90.97 (1.79)	97.43 (0.65)
	P	0.015		<0.0001	
Avg. Heart rate (BPM)	Mean (SD)	131.50 (8.08)	133.30 (7.30)	133.89 (6.41)	133.88 (6.61)
	P	0.0060		0.029	
Avg. Respiration rate (per minute)	Mean (SD)	37.81 (5.22)	38.55 (5.06)	39.37 (3.47)	38.56 (4.24)
	P	0.047		0.035	

BPM=Beats per minute, F=Fahrenheit, BKMC=Before Kangaroo mother care, AKMC=After Kangaroo mother care, SD=Standard deviation

Conclusions

Despite these limitations, Kangaroo mother care, which was given at home, has a similar but statistically significant improvement in vital parameters especially concerning temperature and oxygen saturation. Therefore, KMC helps to stabilize the vital parameters in both hospital and home settings. Our study supports the use of KMC at home in LBW infants mainly in resource-limited coal mines and rural communities.

Key take-home message

If babies in the weight range of 1500 to <2000 g are healthy, stable, well-breast-fed, and have no other risk factors, they can be discharged early and managed at home by delivering supportive care and nursing care along with Kangaroo mother care with continuous follow-up.

Key points

- This study highlights low-cost alternative care to conventional methods for LBW babies in rural, confined-resources, and coalfield communities.
- As primary health care professionals are the first contact person, they can accept the challenge and could visit the community for assisting and promoting the home KMC and save the LBW babies.
- All mothers of rural and poor communities should be encouraged to practice Kangaroo mother care at home after discharge from the hospital.

Consent for publication

The authors agree to publish this study.

Acknowledgment

The authors would like to thank all sisters and paramedical staff of the hospital for extended help and for assisting in all steps of this study. They would also like to sincerely appreciate the family members in the West Bokaro community for their help in all steps of this study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. WHO. Newborns: improving survival and well-being. Geneva: World Health Organization; 2020. https://www.who.int/news-room/fact-sheets/detail/newborns-reducing-mortality. [Last accessed on 2022 June].
2. McCormick MC. The contribution of low birth weight to infant mortality and childhood morbidity. N Engl J Med 1985;312:82-90.
3. UNICEF and WHO. Low Birth Weight: Country, Regional and Global Estimates. UNICEF, New York: 2004.
4. UNICEF and WHO. UNICEF-WHO Low birthweight estimates: Levels and trends 2000–2015. World Health Organization, Geneva: 2019.
5. Bhat BV, Adhisivam B. Trends and outcome of low birth weight (LBW) infants in India. Indian J Pediatr 2013;80:60-2.
6. World Health Organization. Thermal protection of the newborn: A practical guide. World Health Organization; Geneva: 1997. Report No.: WHO/RHT/MSM/97.2.
7. Zanelli S, Buck M, Fairchild K. Physiologic and pharmacologic considerations for hypothermia therapy in neonates. J Perinatol 2011;31:377-86.
8. Meshram RM, Jain DL, Apte MU, Denge A. Morbidity and mortality pattern of the intramural and extramural neonate: a prospective observational study. Int J Contemp Pediatr 2021;8:1006-13.
9. Navjaat Shishu Suraksha Karyakram, Basic newborn care and resuscitation program. Training manual. National Health Mission, New Delhi. Ministry of Health and Family Welfare, Government of India. Available from http://www.nihfw.org/pdf/NCHRC-Publications/NavjaatShishuTrgMan.pdf. [Last accessed on 2015 April 20].
10. Paul VK, Bagga A. Ghai Essential Pediatrics. 10th ed. New York: CBS Press; 2023:148-51.
11. Colonna F, Uxa F, da Graca AM, de Vonderweld U. The "kangaroo-mother" method: Evaluation of an alternative model for the care of low birth weight newborns in developing countries. Int J Gynaecol Obstet 1990;31:335-9.
12. Mehjabeen S, Matin M, Gupta RD, Sutradhar I, Mazumder Y, Kim M, *et al.* Fidelity of kangaroo mother care services in the public health facilities in Bangladesh: A cross-sectional mixed-method study. Implement Sci Commun 2021;2:115.
13. Ruiz-Peláez JG, Charpak N, Cuervo LG. Kangaroo mother care, an example to follow from developing countries. BMJ 2004;329:1179-81.
14. Kangaroo Mother Care in Bangladesh. Dhaka: save the children. Dhaka: Save the Children; 2017. Available from: https://www.healthynewbornnetwork.org/hnn-content/uploads/Bangladesh-KAP-Summary-Sheet.pdf. [Last accessed on 2020 March 24].
15. Verma P, Verma V. Effect of Kangaroo mother care on heart rate, respiratory rate and temperature in low-birth-weight babies. IJRR 2014;2:81-6.
16. Ludington-Hoe SM, Anderson GC, Swinth JY, Thompson C, Hadeed AJ. Randomized controlled trial of Kangaroo care: Cardiorespiratory and thermal effects on healthy preterm infants. Neonatal Netw 2004;23:39-48.
17. Parmar VR, Kumar A, Kaur R, Parmar S, Kaur D, Basu S, *et al.* Experience with Kangaroo mother care in a neonatal intensive care unit (NICU) in Chandigarh, India. Indian J Pediatr 2009;76:25-8.
18. Parsa P, Karimi S, Basiri B, Roshanaei G. The effect of Kangaroo mother care on physiological parameters of premature infants in Hamadan City, Iran. Pan Afr Med J 2018;30:89. doi: 10.11604/pamj. 2018.30.89.14428.
19. Ranjan A, Malik S. Effect of Kangaroo mother care on physiological parameters in low-birth-weight neonates. Int J Contemp Pediatr 2019;6:791-5.
20. Sahbaei Roy F, Shushtarian, Hematyar, Pourzadi M, N Pourzadi. The comparative study of Kangaroo mother care in hospital and at home. IJAR 2014;4:1-4

21. Bera A, Ghosh J, Singh AK, Hazra A, Som T, Munian D. Effect of kangaroo mother care on vital physiological parameters of the low birth weight newborn. Indian J Community Med 2014;39:245-9.
22. Kadam S, Binoy S, Kanbur W, Mondkar JA, Fernandez A. Feasibility of Kangaroo mother care in Mumbai. Indian J Pediatr 2005;72:35-8. doi: 10.1007/BF02760578.
23. Dawar R, Nangia S, Thukral A, Chopra S, Khanna R. Factors impacting practice of home Kangaroo mother care with low birth weight infants following hospital discharge. J Trop Pediatr 2019;65:561-8.
24. Chan G, Bergelson I, Smith ER, Skotnes T, Wall S. Barriers and enablers of Kangaroo mother care implementation from a health systems perspective: A systematic review. Health Policy Plan 2017;32:1466-75.