

## Outcome of Kangaroo Mother Care in Low Birth Weight Babies (Preterm/Lugr)

Simy Mathew<sup>1</sup>, Jyoti B Sarvi<sup>2</sup>

<sup>1</sup>Practising Pediatrician, Bangalore, India, <sup>2</sup>Senior Resident, Department of Pediatrics, Gulbarga Institute of Medical Science, Kalaburagi, Karnataka 585101, India.

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### Abstract

*Aims and objectives:* To identify changes in the specific parameters (anthropometry, hypothermia, hypoglycaemia, sepsis) of neonates receiving 'KMC'. To identify feeding patterns and sleep pattern in babies receiving KMC. To determine Mother's perception during KMC.

*Methods and Material:* It is a prospective case study, studying the outcome of Kangaroo Mother Care given to babies (32-40 weeks), weighing 1.5-2 kg born by normal vaginal delivery in Basaveshwar and Sangameshwar Teaching and General Hospital, Gulbarga.

*Results:* Our study group of 150 neonates included males more than females, SGA more than AGA, late preterm more than early preterm and term neonates. Neonates body temperature significantly increased after KMC. A significant increase in respiratory rate, decrease in heart rate and increase in oxygen saturation was seen in neonates receiving KMC in our study. Our study recorded a higher proportion of neonates achieving transition from predominant expressed breast milk consumption (paladai or wati) to predominant direct breastfeeding during hospital kangaroo mother care. Also all infants were on exclusive breast feeding at follow up and on were on regular supplements. Behavioral state of the babies before and during KMC was studied using modified BRASELTON behavioral assessment scale and it found that there was increased deep quiet sleep state (80%) during KMC. The mean crying state was found to be less during KMC(4%). There was significant mean weight gain of 20 gm/day during hospital KMC and during follow up, also babies with KMC had better weekly length increment. Maternal acceptance of KMC was good and concurred with other studies. (85.3%) mothers in our study strongly agreed that KMC provides warmth to the babies. 88% mothers felt that their baby is secure and majority of them felt that baby sleeps better and that it improves the weight of the baby. All the mothers were able to practice KMC at home and no adverse events were reported. The response of the family and/or the father was supportive.

*Conclusion:* KMC promoted an improvement in body temperature, thereby contributing towards improvement of thermal control, decreased heart rate, increased peripheral oxygen saturation, improvement of tissue oxygenation and improved breathing rate, which brought greater respiratory comfort to the newborns. Thus, KMC promoted beneficial physiological changes for low-weight PTNBs and contributed significantly to their physiological control.

Kangaroo mother care accelerates growth pattern in LBW babies and reduces hospital stay. By promoting kangaroo mother care, exclusive breast feeding was ensured in LBW babies.

Kangaroo mother care had a protective effect on morbidities like hypothermia, sepsis and apnea. It is superior alternative to conventional method of care in institutions with limited resources.

**Keywords:** Kangaroo mother care; Anthropometry; Physiological changes.

**Corresponding Author:** Jyoti B Sarvi, Senior Resident, Department of Pediatrics, Gulbarga Institute of Medical Science, Kalaburagi, Karnataka 585101, India.

E-mail: sarvi11289@gmail.com

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## Introduction

Some 20 million neonates are born each year, because of either preterm birth or impaired prenatal growth, mostly in less developed countries [1]. The important birth outcomes related to LBW include both neonatal death and post neonatal death, short-term morbidities such as hypothermia, hypoglycaemia, respiratory distress syndrome, infections and necrotizing enterocolitis, and long-term morbidities such as blindness, deafness, hydrocephaly, mental retardation, and cerebral palsy [2]. LBW and preterm birth are thus associated with high neonatal and infant mortality and morbidity. Of the estimated 4 million neonatal deaths, preterm and LBW babies represent more than a fifth. Therefore, the care of such infants becomes a burden for health and social systems everywhere [1].

In most countries, the use of incubators is standard for thermal care of LBW babies. However, “*incubator care*” is not widely available in developing countries, especially outside of large cities. Even in the limited cases where incubator care is available, the use of this method can be very challenging. Problems such as poor maintenance, power outages and lack of replacement parts reduce the number of available, functional incubators. In addition, excess demand resulting from too many LBW newborns and insufficient machines results in many babies sharing an incubator. This practice, along with inadequate disinfection of incubators, can lead to increased infection rates. Untrained or poorly trained health personnel or insufficient staff available on a 24-hour basis can also impact the quality of incubator care provided in these settings. Since it largely excludes the participation of the mother, incubator care can also lead to decreased breastfeeding and maternal-newborn bonding. Given the cost of incubators and the operational and programmatic challenges, making incubator care available and accessible to the majority of families of LBW babies is simply not an option in most developing countries. Fortunately, there is an alternative approach for providing thermal care for and improving survival of LBW infants that is both effective and affordable—namely, *Kangaroo Mother Care*, or *KMC* [3].

KMC method was developed in the 1970’s in Colombia by neonatologists Edgar Rey Samaria and Hector Martinez Gomez, in response to overcrowded neonatal care units. This method includes three main components: 1) skin-to-skin contact—a newborn baby is kept in a prone position

between the mother’s breasts several hours a day; 2) exclusive on-demand breastfeeding; and 3) early hospital discharge with appropriate follow-up [4]. In addition, the baby is colonized by the mother’s commensal organisms reducing the risk of nosocomial infections especially in a hospital environment. KMC can be started after birth as soon as the baby is clinically stable, and can be continued at home until the baby is stronger and begins to wriggle out which is often around the time the baby would have been born if they had been full term [5]. The most recent definitions of KMC: ‘a standardized, protocol-based care system for preterm and/or LBW infant, based on skin-to-skin contact between the preterm baby and the mother. It is a conceptually simple, elegant technique in which the role of kangaroo healthcare providers is basically to teach, coach, offer expert counselling, and closely monitor the mother infant dyad. It is not “alternative” medicine but a scientifically sound, multilevel intervention [6].

However, kangaroo mother care (KMC) is an effective way to meet baby’s needs for warmth, breastfeeding, protection from infection, stimulation, safety and love [1].

In our tertiary care hospital, with 30% preterm and LBW neonates being born each year and many cases being referred from peripheral centres, care of these newborns are a challenging task. Hence this study is undertaken to evaluate role of KMC in premature and LBW neonates.

## Materials and Methods

### *Source of Data*

A prospective case study will be carried out in babies (32–40 weeks), born through normal vaginal delivery weighing between 1.5–2.0 kg born in Basaveshwar Teaching & General Hospital and Sangameshwar hospital attached to M.R. Medical College, Gulbarga.

*Method of Collection of Data (including sampling procedure if any):*

In this prospective case study,

*Cases* - Babies (32–40 weeks), born through normal vaginal delivery weighing between 1.5–2.0 kg born in Basaveshwar and Sangameshwar Teaching & General Hospital receiving KMC.

*KMC group:* Mothers in the KMC group will be explained in detail about KMC adoption in the presence of their family. KMC will be initiated

as soon as the baby is stable. The mothers will provide skin to skin contact using a specially tailored Kangaroo bag made of soft flannel cloth. The mothers will be encouraged to keep the baby in KMC as long as possible during the day and night with a minimum period of one to two hours at a time. When the baby is receiving intravenous fluids, mother will provide kangaroo care seated in a comfortable chair placed close to the baby's cradle. Once the baby is on full feeds, she provides kangaroo care on the reclining cot in the semi upright position with the help of pillows.

#### *Anthropometry:*

Babies will be weighed naked on an electronic weighing scale (Conweigh Electronic weighing scale - accuracy of  $\pm 5$  g) immediately after birth and subsequently daily till discharge. The weighing machines were calibrated daily with 5 g standard weight. The length will be measured at birth, on discharge and on each follow-up visit by using an infantometer.

Head circumference (HC), chest circumference (CC), and foot length will be measured by standard methods at birth, on discharge and on each follow-up visit with a non-stretchable tape. All measurements will be carried out by the same clinician.

Modified Braselton Behavioral Assessment Scale (1984) is used for the assessment of behavioral state and they are graded as follows;

Deep quiet sleep state (DQS) (score-6)- closed eyes, with no eye or body movement, little or no response to noise or stimuli Active sleep state (ASS) (score-5) -movement of extremities, stretching of limbs body, changes offacial expression, eyes closed with eye movement and started with noise ordisturbance.

Drowsy state (DS) (score-4)- eyes opened or closed and if eyes open, appearing glazed and unfocussed, quiet, startle present or slow movement of extremities.

Quiet alert state (QAS) (score-3)- eyes opened, bright and interested in their surrounding and the presence of minimal body movements.

Active alert state (score-2)(AAS)- being, fussy, restless, opened eye, movement of face, handsand legs. Crying state (score-1)(CS)- continuous cry (lusty cry), red face and presence of movement of hands and legs.

*Feeding:* All babies were exclusively breastfed and those unable to take direct breastfeeds were

given expressed breast milk by nasogastric tube or using a pallada or sterile wati and spoon. Feeding practice were noted before KMC, at discharge and at follow up. Trained nursing assistance was provided whenever required. They were also supplemented with calcium (100 mg/kg/d), phosphorus (50 mg/kg/d) and multivitamin supplements.

*Monitoring:* Neonates vital parameters [temperature with clinical thermometer, respiratory rate and heart rate by clinical examination and oxygen saturation with pulse oxymeter were monitored twice a day till discharge. Babies will be monitored for hypothermia, hypoglycemia, sepsis, feeding problem and other morbidities. Babies who develop a life threatening event like convulsions, hypothermia, and severe sepsis will be considered as critically ill and will be temporarily withdrawn from the KMC group. Babies requiring phototherapy will also be temporarily withdrawn from KMC group.

*Discharge and follow up:* Babies will be discharged when they show a weight gain of 10-15 g/kg/d for three consecutive days, are feeding well, maintaining temperature without assistance and the mother is confident of caring for her baby. They were followed up in OPD at post menstrual age of 40 weeks in preterm babies or at chronological age of 6 weeks in term SGA babies for compliance with KMC, anthropometry and morbidity and mortality.

Mother was advised about personal care, diet, benefits of the procedure for herself and was adequately supported with KMC pouch to carry newborn. Mothers in the KMC group will be interviewed on a pre-structured questionnaire to assess the acceptability and feasibility of KMC in the hospital and at home.

#### *Inclusion Criteria*

1. Mothers availability at the time of Data collection.
2. Mothers with Low Birth - Weight babies (1.5-2.0 kg).
3. Mothers willing to participate.

#### *Exclusion Criteria*

1. Babies less than 1.5 or more than 2.0 kg.
2. Babies delivered by caesarean section requiring NICU, critically ill, ventilator care, inotropic support, with chromosomal or life threatening congenital anomalies.
3. Mothers not willing to participate.

*Sample Size and Design*

This is a prospective case study which will be done over a period of one and half years and a minimum of 150 babies will be taken. The number of cases may increase depending on the availability in our hospital

*Statistical Methods*

- Data was entered using MS Excel 2007.
- Data imported to SPSS 17.0 version software.
- Descriptive statistics was used to analyse non parametric tests. Chi square tests was used to asses significant difference between 2 groups and p<0.05 was considered significant.
- Student 't' test was used to compare 2 groups of continuous data. p<0.05 was considered significant and p<0.001 was considered highly significant.

**Results**

**Table 1:** Distribution of Neonates According to Sex

Sex	No	%
Male	100	66.67
Female	50	33.3
Total	150	100

Table 1 shows Male babies were more than Females.

**Table 2:** Distribution of Neonates According to Gestational Age and Weight Appropriateness for GA.

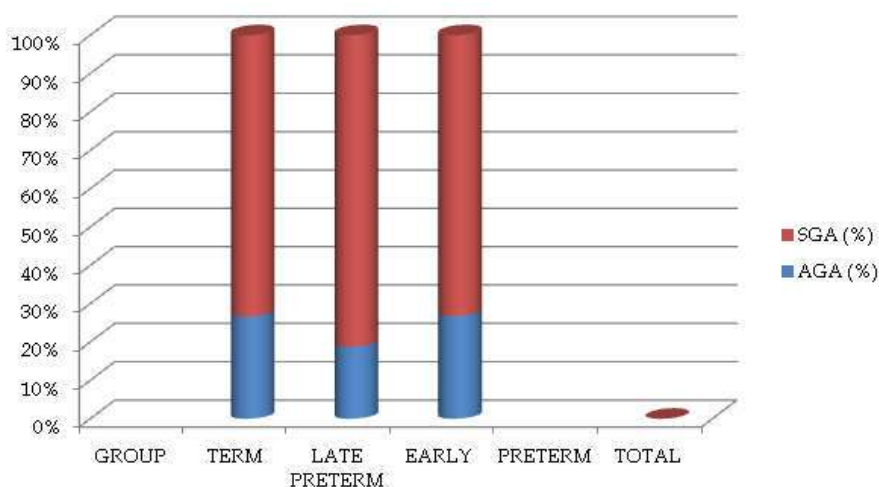
Group	AGA (%)	SGA (%)	Total (%)
Term	8	22	30 (20%)
Late Preterm	12	52	64 (42.6%)
Early Preterm	15	41	56 (37.3%)
Total	35 (23.3%)	115 (76.6%)	150

Table 2 shows in decreasing order of frequency neonates studied were late preterm, early preterm and term. SGA were more than AGA. Among SGA late preterm were majority and AGA early preterm were majority (Graph 1).

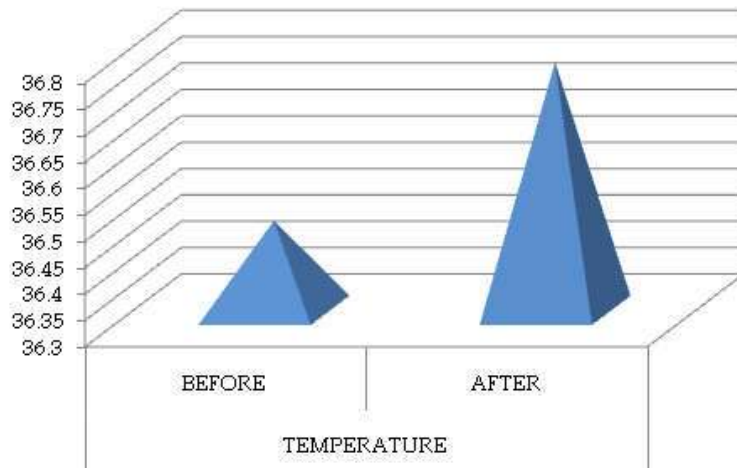
**Table 3:** Vitals of Neonates Before and After KMC.

Vitals		Mean	Std. Deviation
Temperature	Before	36.47	.17
	After	36.77	.24
Respiratory Rate	Before	38.24	20.91
	After	42.8	16.48
Heart Rate	Before	135.92	40.07
	After	128.57	45.78
Saturation	Before	94.92	1.44
	After	97.18	.69

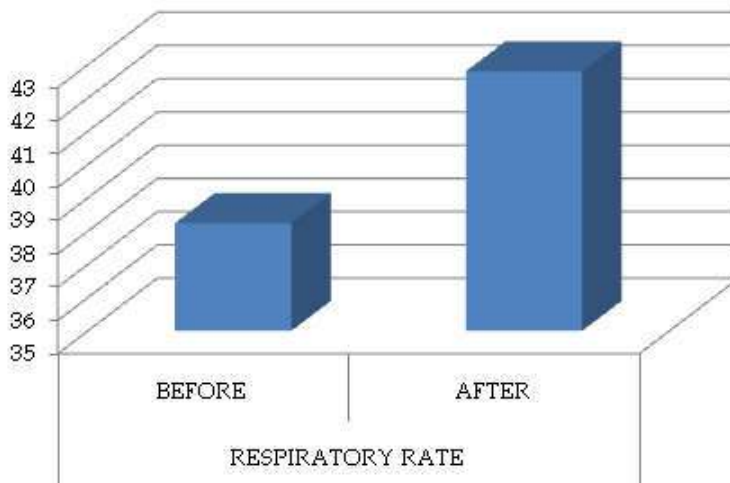
Table 3 evaluating vitals showed after KMC, newborns axillary temperature raised by 0.280 celsius, respiratory rate increased by 5/min, heart rate decreased by 8/min, saturation increased by 2% (Graph 2-5).



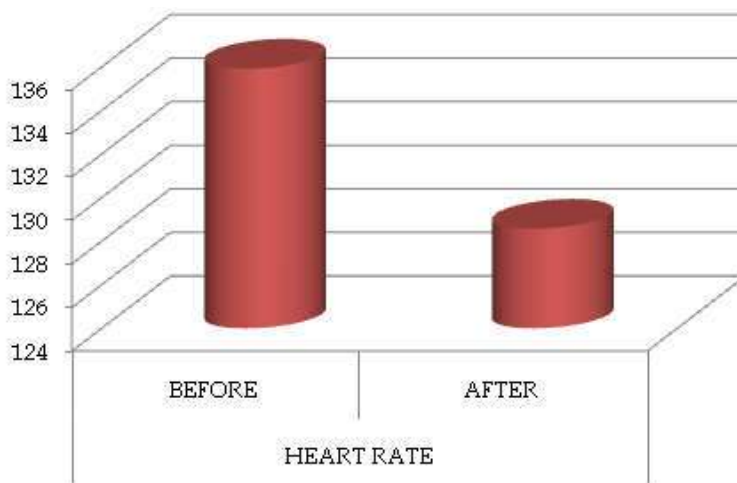
**Graph 1:** Distribution of Neonates According to Gestational Age and Weight Appropriateness for Gestational Age.



Graph 2: Temperature of Neonates Before and After KMC.



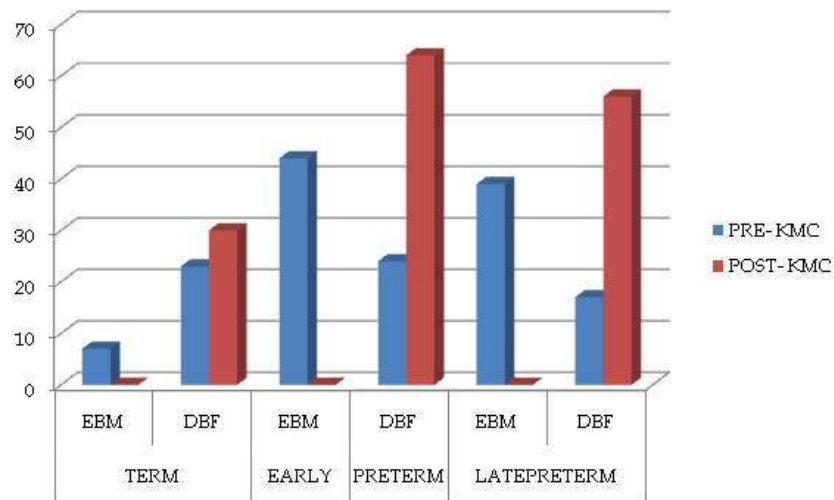
Graph 3: Respiratory Rate of Neonates Before and After KMC.



Graph 4: Heart Rate of Neonates Before and After KMC.



Graph 5: Saturation of Neonates Before and After KMC.

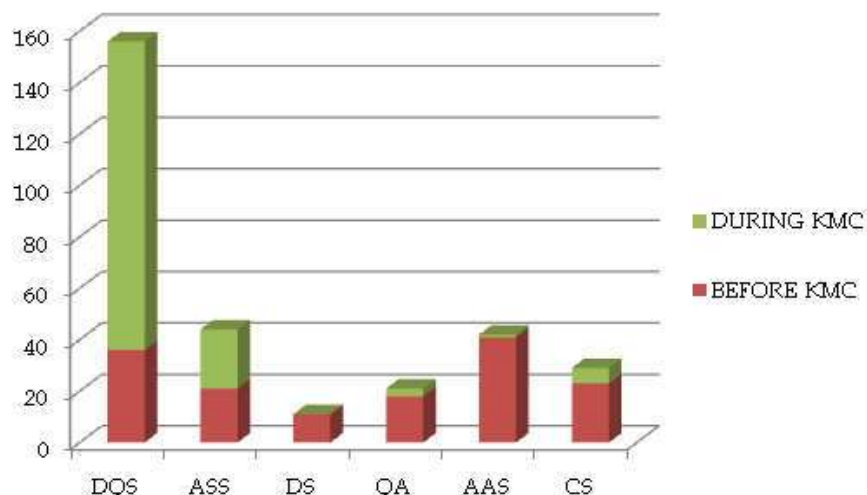


Graph 6: Feeding Method of Neonates Before and After KMC

Table 4: Feeding Method of Neonates Before and After KMC.

Group	Feeding Method	PRE- KMC	Post- KMC
Term	EBM	7	0
	DBF	23	30
Early Preterm	EBM	44	0
	DBF	24	64
Latepreterm	EBM	39	0
	DBF	17	56

Table 4 shows expressed breast milk was the predominant mode of feeding among early preterm and late preterm before KMC, which shifted to predominant direct breastfeeding after KMC (Graph 6).



Graph 7: Behavioural State of Babies During KMC

Table 5: Behavioural State of Babies During KMC

Behavioural State	DQS	ASS	DS	QA	AAS	CS
Before KMC	36 (24%)	21 (14%)	11 (7.3%)	18 (12%)	41 (27.3%)	23 (15.3%)
During KMC	120 (80%)	23 (15.3%)	0	3 (2%)	1 (.6%)	6 (4%)

Table 5 shows the computed value of behavioural state of neonates during KMC. Increased deep quiet sleep state (80%) was found during KMC. The mean crying state was found to be less during KMC (4%) (Graph 7).

Table 6: Average Weight Gain in Different Groups During Hospital KMC Stay.

	Mean	STD. Deviation	Minimum	Maximum
Term	21.94	8.61	10.00	40.00
Late Pre Term	20.58	12.09	-17.50	92.50
Early Pre Term	18.76	10.33	-20.00	70.00
Total	19.93	11.33	-20.00	92.50

Table 6 shows average weight gain during KMC stay was 21.94 g/kg/day in term, 20.58 g/kg/day in late preterm and 18.76 g/kg/day in early preterm. The average day when neonates started gaining weight irrespective of groups was 8.5 days and average weight gain irrespective of groups is 19.9 g/kg/day.

Table 7: Morbidity of Neonates Enrolled in Our Study During Hospital KMC Stay.

	No.	%
Hyperbillirubinemia	4	-

Sepsis	5	-
Apnea	1	-
Hypothermia	0	-
Hypoglycemia	2	-

Table 7 shows morbidity of neonates observed during KMC ward stay were sepsis (5), apnea (1), hypoglycemia (2) and hyperbilirubinemia in (4).

Table 8: Morbidity of Neonates Enrolled in Our Study During Follow Up.

	No.	%
Severe Infection	1	-
Poor Weight Gain	2	-
Disability	0	-
Death	1	-

Table 8 shows morbidity of neonates observed during follow-up were poor weight gain was observed in 2, severe infection in 1, and death in 1.

Table 9: Perception of Mother Regarding Effect of KMC on Baby

Variables	Strongly agree	%	Agree	%	Undecided	%	total
KMC provides warmth	128	85.3	20	13.3	2	1.3	150
Baby feels secure	132	88	18	12	-	-	150
Reduces duration of hosp stay	122	81.3	18	12	10	6.6	150
Increases wt of baby	140	93.3	10	6.6	-	-	150
Duration of sleep is increased	142	94.6	8	5.3	-	-	150

Above table 9 shows that (85.3%) mothers strongly agreed that KMC provides warmth to the

babies. 88% mothers feels that their baby is secure and majority of them feel that baby sleeps better and that it improves the weight of the baby.

Above data reveals that mothers are well aware about benefits of KMC for mothers.

### Discussion

Kangaroo mother care has been proposed as an alternative method for caring low birth weight neonate. The method was first implemented by Roy and Martinez in 1979 at Maternal and Child Institute of Bogota, Colombia. It consists skin to skin contact, exclusive breast feeding and early discharge.

In India since its recommendation by WHO in 2003, its implementation is poor in spite of evidence favoring KMC as observed by Lawn et al. [8]. In Karnataka, many institutes have adopted this technique of care for low birth weight babies. One such institute is Basaweshwar and Sangameshwar Teaching and General hospital.

A hospital based observational study was performed on LBW neonate fulfilling inclusion criteria and shifted to ward, attached to level 3 NICU over a period of one- year and 6 months.

Our study group of 150 neonates included males more than females, SGA more than AGA, late preterm more than early preterm and term neonates.

In our study, neonates body temperature significantly increased after KMC. This is in accordance to study performed by Dandekar RH et al. [9] Ghavane et al. [10] Gathwala G. et al. [11] and many others. Baby is in contact with warm maternal skin and receives heat from mother's breast on each side and from her chest in front and rise in skin temperature is as a result of conductance of heat from the mother to the infant.

Placement of the infant underneath a blouse improved insulation and prevents heat loss during the maternal kangaroo care. Higher temperature in the skin-to-skin contact in the present and the earlier studies provide evidence that maternal body is an efficient heat source for the baby. Thermal control is very important for LBW neonates because of their greater tendency towards hypothermia, and it thus contributes towards homeostasis.

A significant increase in respiratory rate, decrease in heart rate and increase in oxygen saturation was seen in neonates receiving KMC in our study. Acholet et al. [17] and Kadam et al. [14] found higher oxygen saturation and reduction in respiratory rates after KMC. Ventilation and

perfusion are gravity dependent, so an upright position optimizes respiratory function. Also since the newborn is calm and comfortable in contact with its mother, this probably decreases the consumption of oxygen and thus causes an increase in saturation.

Decrease in heart rate may be associated with lower stress, calmer experiences in relation to the hospital routine and calm sleep. In our study though respiratory rate increased in contrast to Acholet et al. [17] and Kadam et al. [14] it was towards normal.

Present study recorded a higher proportion of neonates achieving transition from predominant expressed breast milk consumption (paladai or wati) to predominant direct breastfeeding during hospital kangaroo mother care. This was in accordance with Rao et al. (98%) [13] and Ramnathan et al (86%) [15]. Also all infants were on exclusive breast feeding at follow up and on were on regular supplements.

In our present study, behavioral state of the babies before and during KMC was studied using modified Braselton behavioral assessment scale. We found that there was increased deep quiet sleep state (80%) during KMC. The mean crying state was found to be less during KMC (4%). This finding was in comparison to the study done by Cattaneo A. Davanzo R, and Tamburlini G.

The study showed significant mean weight gain of 20 gm/day during hospital KMC and during follow up. This is in accordance with observation made by Cattaneo et al. (21.3 gm), [17] K. Ramanathan, et al. (15.9 gm), [15] Rao et al. (23.9 gm) [13] and Gathwala et al. (21.92 gm) [11]. We found that babies with KMC had better weekly length increment. This outcome was similar to study by Rao et al. [13] The increase in physical growth more rapidly may be due to exclusive breastfeeding, temperature maintenance, physiologic stability and decreasing morbidities. In our present study babies who had received KMC had better increment in weekly head circumference. This finding was similar to observations made by Rao et al. (0.75 cm) [13] and Gathwala et al. (0.59 cm) [11].

We could not confirm when the birth weight was regained as babies were discharged earlier and many did not turn up for initial follow up., but average duration needed when weight gain began after starting KMC was 8.5 days of chronological age in all groups.

Morbidity of neonates requiring NICU admissions apart from LBW in study were hyperbilirubinemia, sepsis, respiratory illness,



hypothermia, metabolic cause, central nervous system illness. In present study the babies receiving KMC had no hypothermia, This finding was similar to Kadam et al. [14] Rao et al. [15] Also, we hardly found any sepsis (5/150) which was in comparison to the findings of Rao et al. (4/103) [15] and Syed Ali et al. (4/58) [12]. The reason accounted for it might be due to early hospital discharge resulting in decreased chances of hospital acquired infection. The episodes of apnea in <32 weeks babies in KMC group was significantly less (1/300). This finding is similar to the finding of Rao et al. (4.3%) [15] and Syed Ali et al. (1.7%) [12]. Also 2 babies had hypoglycemia and 4 developed hyperbilirubinemia, which is common complication of preterm and it was managed as per protocol.

Most of neonates were observed on follow up at Newborn OPD. The rate of weight gain was satisfactory, with only 2 babies showing poor weight gain who were admitted and evaluated. Our study recorded a higher proportion of exclusive breastfeeding during follow up among KMC infants. Charpak et al. [16] reported that the proportions of KMC mothers who breastfed up to 3 months exclusively were significantly higher on statistical analysis. Higher breastfeeding rates were also observed by Ramnathan et al. [15] Morbidity in neonates observed during follow-up were severe infection in 2 requiring hospitalization. One baby with severe infection which was re-hospitalized expired, however these causes are not just directly related to KMC. Conde-Agudelo A et al. [7] found no evidence in difference in infant mortality in KMC as compared to conventional care after stabilization.

One of the strengths of our study is the high follow-up rate among KMC infants, comparable to other studies. The better follow-up rate in the KMC group could be due to the active involvement of the mother in the care of her LBW baby or the strong rapport between the KMC mother and the health personnel. Home visit was not possible in the present study. However, the higher follow-up by KMC mothers suggests that early discharge with regular follow-up of LBW infants is definitely feasible without compromising on the health of the baby.

In the present study, maternal acceptance of KMC was good and concurred with other studies. (85.3%) mothers in our study strongly agreed that KMC provides warmth to the babies. 88% mothers felt that their baby is secure and majority of them felt that baby sleeps better and that it improves the weight of the baby. All the mothers were able to practice KMC at home and no adverse events

were reported. The response of the family and/or the father was supportive. Few mothers during hospital KMC stay were confident enough to serve as advocates for KMC and they were an important source of support for the newly enrolled mothers. This study has demonstrated that KMC is feasible in the Indian household. However, KMC was initiated in the hospital under close supervision and guidance and only later continued at home. Further research should investigate the implementation of KMC after initiation in the community.

The limitations of our study are it's an observational study, sample being purposive and not a true representative of study population. As our study is confined to our hospital setting, the generalization to community cannot be made.

### Conclusion

KMC promoted an improvement in body temperature, thereby contributing towards improvement of thermal control, decreased heart rate, increased peripheral oxygen saturation, improvement of tissue oxygenation and improved breathing rate, which brought greater respiratory comfort to the newborns. Thus, KMC promoted beneficial physiological changes for low-weight PTNBs and contributed significantly to their physiological control.

Kangaroo mother care accelerates growth pattern in LBW babies and reduces hospital stay. By promoting kangaroo mother care, exclusive breast feeding was ensured in LBW babies.

Kangaroo mother care had a protective effect on morbidities like hypothermia, sepsis and apnea. It is superior alternative to conventional method of care in institutions with limited resources.

LBW neonates mothers with the following antenatal risk factors (PROM, maternal anemia, PIH, twins, APH), medical disease (hypertension, diabetes, seizure disorder and infertility) needs immediate attention. Need of antenatal visits, home delivery risks, and contraceptive awareness needs to be spread. Strict hospital policy regarding antenatal screening for pregnancy related diseases, nutritional supplementation, indications for induction of labour, and awareness about care of newborn and KMC needs to be emphasized.

### Recommendations

1. KMC is an effective intervention, which

- can be safely included in the management of LBW neonates in kangaroo care ward and in NICU. KMC can be implemented as alternative method where NICU is overburdened with LBW neonates.
2. Education on KMC and its benefits should be organised for nurses and primary health care workers. Education and demonstration must be provided to each mother of LBWI and they should be encouraged to practice KMC.
  3. The LBW neonates should strictly be monitored before initiating KMC in hospital and after early discharge for any new complications.
  4. Nurses and mothers must be encouraged to follow hygiene practices necessary to avoid infections.
  5. Appropriate feeding method need to be individualised to each LBW neonate and trained nurses need to support mother during hospital KMC stay.
  6. Morbidity associated with LBW neonates should be followed up strictly in High Risk Clinic and early interventions are taken.
  7. Once KMC is accepted by health facilities and medical professionals, it will be easier to extend the approach to the community, where KMC has the potential to reach numerous LBW babies.

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