

**Effect of Kangaroo Mother Care in Low-Birth-Weight Neonates Admitted in Special Newborn Care Unit**Ekta Atulbhai Dalal<sup>1</sup>, Seema Suketu Shah<sup>2</sup>, Kishan Kumar Nakum<sup>3</sup><sup>1</sup>Associate Professor, Department of Pediatrics, GMERS Medical College, Gandhinagar, Gujarat, India<sup>2</sup>Associate Professor, Department of Pediatrics, Dr. M.K. Shah Medical College and Research center, Chandkheda Ahmedabad, India<sup>3</sup>Third Year Resident, Department of Pediatrics, GMERS Medical College, Gandhinagar, Gujarat, India

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Corresponding Author: Dr. Ekta Atulbhai Dalal

Conflict of interest: Nil

**Abstract:**

**Background and Aim:** Kangaroo Mother Care (KMC) implies placing the newborn baby in intimate skin-to-skin contact with the mother's chest and abdomen coupled with frequent and preferably exclusive breast feeding. The objective of our study was to assess the physiological state of LBW babies during KMC in a teaching hospital setting, to study the weight gain pattern and the duration of stay of these neonates in whom KMC was implemented in a tertiary care setting. The broader intention is to generate data to recommend wider implementation of the strategy.

**Material and Methods:** The present study was carried out in the Neonatal Intensive Care Unit, Department of Pediatrics, GMERS Medical College, Gandhinagar. 150 neonates selected from study population. The length was measured at birth, at enrolment in study and thereafter at the time of discharge by using an infantometer. Head circumference (HC) was measured first after 24 hours of birth, at enrolment in study and weekly thereafter at the time of discharge by standard method via measuring tape. Enrolled neonates were followed up till 3 months of age. At the end of 3 months, neonates were divided into 2 groups. Group A: Neonates who had received KMC at home and Group B: Neonates who had not received KMC at home. At 3 month of age - neonate weight, head circumference and length were measured; from which average weight gain/day, head circumference/week, length increment/week was calculated in both groups.

**Results:** At the time of initiation of KMC during hospital stay, the feeding type BF, KSF and RTF noted in 7.3%, 14% and 50.7% participants respectively. Mean height, Length, Weight and Head Circumference value of group A differed statistically significantly between time points at initiation of KMC, at discharge and follow-up visit ( $P < 0.05$ ). KMC at home was given in 70% participants who came for follow-up. Practice of KMC continued at home provides better neuro-stimulation and intact neuro-development outcome at corrected gestational age.

**Conclusion:** KMC has significant role in growth improvement, exclusive Breastfeeding rate, decreasing morbidities, reducing the need of extra equipments, antibiotics, artificial milk and empowering the mother as primary care provider; KMC has major role in conserving the scarce resources and personnel in limited resources area.

**Keywords:** Head circumference, kangaroo mother care, Low Birth Weight, Neonates.

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**Introduction**

A newborn infant weighing less than 2500g at birth is termed as low birth weight neonate (LBW). Low birth weight in a neonate results due to intrauterine restriction or prematurity. [1] With advance in neonatology improved technology and protocols used in neonatal resuscitation and later newborn care more and more low birth weight babies are surviving.

A systematic analysis of global, regional and national causes of child mortality identified preterm with low birth weight with complications and

infections to be two major causes of neonatal death in India, preterm low birth weight with complications contributing to 44 % of the neonatal deaths. [2] Medical cost is also significantly higher in caring for preterm and other LBW babies. LBW occurs in about 20-30% of all live births in India. [3]

A major problem with such babies is their inability to control body temperature- a preventable cause of their morbidity and mortality. A study from India revealed that 2.9 % intramural babies and 45%

babies born at home developed mild to moderate hypothermia. [4] Kangaroo Mother Care (KMC) implies placing the newborn baby in intimate skin-to-skin contact with the mother's chest and abdomen coupled with frequent and preferably exclusive breast feeding. This is similar to marsupial care- giving, where the premature baby is kept warm in the maternal pouch. KMC has emerged as a non- conventional low cost method for newborn care that provides warmth, touch and security to the newborn and is believed to confer significant survival benefit. Indian data on outcome of KMC are limited, though it has been found to be an effective and feasible method of care of LBW babies in hospital setting. [5]

With this background, the objective of our study was to assess the physiological state of LBW babies during KMC in a teaching hospital setting, to study the weight gain pattern and the duration of stay of these neonates in whom KMC was implemented in a tertiary care setting. The broader intention is to generate data to recommend wider implementation of the strategy.

#### Material and Methods

The present prospective interventional cohort study was carried out in the Neonatal Intensive Care Unit, Department of Pediatrics, GMERS Medical College, Gandhinagar. The Hospital caters to population from different socio-economic backgrounds from Gandhinagar and neighbouring districts as well. 150 neonates selected from study population based on predefined eligibility criteria comprised the study sample. Sample size was estimated using formula  $z^2 \times p(1-p)/e^2$ .

All neonates admitted with birth weight <2500 g in our special newborn care unit in hospital, who are thermodynamically stable and able to or not able take oral feeds either direct or expressed breast milk in the form of cup/ katori feeding or nasogastric tube feeding will be included in the study.

#### Exclusion Criteria:

- Neonates with gestational age < 28 weeks (extreme prematurity)
- Birth weight < 1 kg (extreme low birth weight)
- Birth weight < 1.5kg (very low birth weight) with comorbidities
- Critically ill babies requiring ventilator support

After the counselling, mother provided KMC in specially designed KMC chair or at KMC room where special fowler beds were available. Specially designed KMC gowns were given to the KMC provider to practice KMC. The mothers were encouraged to provide KMC to neonates for as long as possible.

Each session lasted for at least 1 hour. The daily sessions and duration of each session were recorded in a pre-structured KMC chart by a trained staff nurse of NICU. Babies were weighed naked on an electronic weighing scale immediately after birth and subsequently daily one hour after feeds till discharge. The length was measured at birth, at enrolment in study and thereafter at the time of discharge by using an infantometer. Head circumference (HC) was measured first after 24 hours of birth, at enrolment in study and weekly thereafter at the time of discharge by standard method via measuring tape.

All neonates were kept NBM or given breast milk by infant feeding tube or by katori spoon or direct breastfeeding according to gestational age, birth weight, day of life and associated morbidities. Duration of transition from NBM to RTF, from RTF to KSF, from KSF to direct breastfeeding was recorded in the chart.

Neonate's axillary temperature was recorded by clinical thermometer twice a day and as and when required. Neonate's blood glucose was monitored by glucometer once in a day and as and when required. Neonate was also monitored for apnoea, sepsis or any other problem during the hospital stay. For assessing the analgesic effect of KMC, only neonates with gestational age 34 –36 week were included. Assessment of pain was done by PIPP score – Premature infant pain profile [6-8]

55 neonates were studied; neonates were study two times one with KMC and one when same newborn kept in warmer which we called: Pre KMC group & Post KMC group. Neonates were fed at least 1 hour before procedure. Basal heart rate and oxygen saturation and behavioural expression were recorded when neonate was calm before the heel prick. In Pre KMC group, neonates directly heel prick was done when neonate received 30 minutes of KMC and after these 30 minutes, heel prick was done by 26" needle on the lateral aspect of the sole. Observer observed the maximum heart rate and minimum SpO2 in pulse oximeter for 30 seconds from the time of insertion of the needle. Same procedure repeated when patient kept in radiant warmer for 30 minutes. All events were recorded in the proforma. From all the above data, PIPP score was calculated.

Enrolled neonates were followed up till 3 months of age. At the end of 3 months, neonates were divided into 2 groups.

- Group A: Neonates who had received KMC at home
- Group B: Neonates who had not received KMC at home

At 3month of age (corrected gestational age)-neonate weight, head circumference and length

were measured; from which average weight gain/day, head circumference/week, length increment/week were calculated in both groups. No of neonates on exclusively breast feeding, on top feed & on mixed feeding (breast feeding + top feeding) were obtained in both groups. Development assessment was done by INFANIB [9,10]

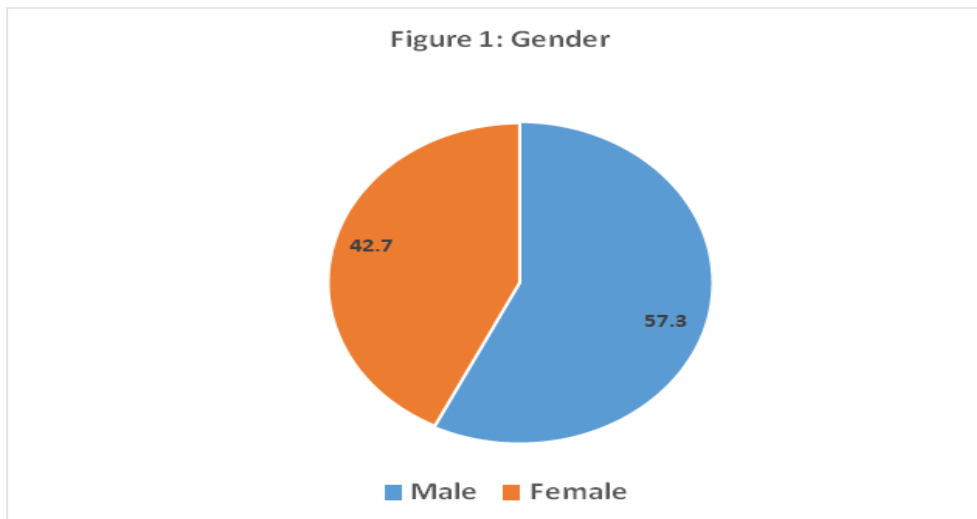
**Statistical Analysis**

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel

2019) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). Quantitative variables were described as means and standard deviations or median and interquartile range based on their distribution.

Qualitative variables were presented as count and percentages. For all tests, confidence level and level of significance were set at 95% and 5% respectively.

**Results**



**Figure 1: Gender**

Figure 1 shows that 57.3% and 42.7% participants were delivered male and female baby respectively. 63.3% and 36.7% participants were delivered full-term and preterm baby respectively.

**Table 1: Diagnosis [N=150]**

Diagnosis	Number	%
LBW	82	54.7
Prematurity RDS of newborn	13	8.7
Transient tachypnea IUGR	12	8
Neonatal sepsis Birth Asphyxia	8	5.3
Neonatal Jaundice	7	4.7
Congenital malformation	6	4
Other	6	4
	5	3.3
	4	2.7
	7	4.7

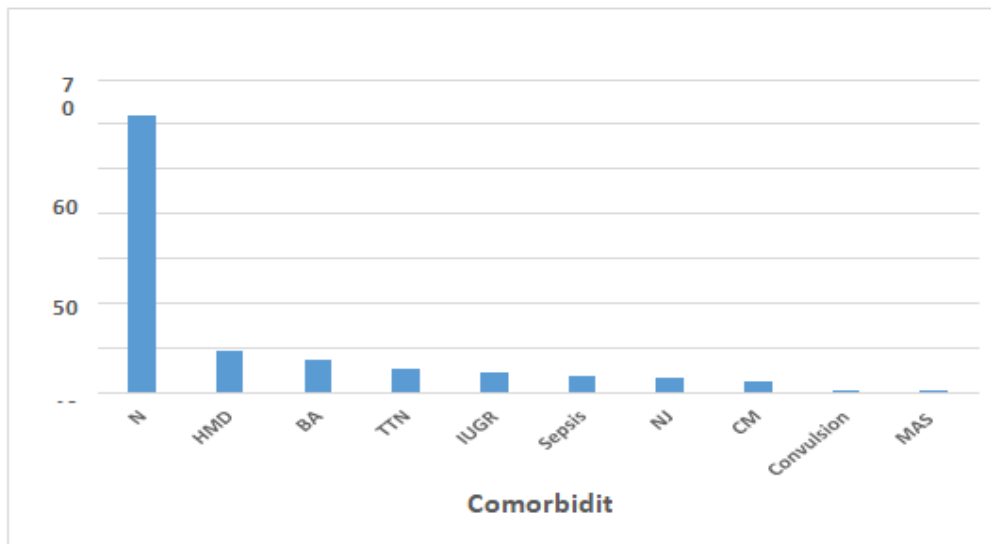
Table 1 shows that 54.7%, 8%, 8%, 5.3%, 4.7%, 4%, 4%, 3%, 3%, 2.7% and 4.7% baby diagnosed with LBW, Prematurity, RDS of newborn, Transient tachypnea, IUGR, Neonatal sepsis, Birth Asphyxia, Neonatal Jaundice, Congenital malformation and Other respectively. Mean gestation age was 35.6 week with 2.2 SD.

**Table 2: Feeding status [N=150]**

Feeding status	At the time of initiation of KMC		At the time of discharge		P value
	N	%	N	%	
Brest	11	7.3	118	78.7	
Feeding					
Katori-	21	14.0	3	2.0	

spoon					<b>0.0001</b>
feeding					
Ryle's tube	76	50.7	0	0.0	
feeding					

Table 2 shows that at the time of initiation of KMC during hospital stay, the feeding type BF, KSF and RTF noted in 7.3%, 14% and 50.7% participants respectively. At the time of discharge from the hospital, the feeding method was BF, KSF and RTF noted in 78.7%, 2% and 0.0% participants respectively. The difference between feeding pattern 'at initiation of KMC' and 'at discharge' was statistically significant ( $p < 0.05$ ).



**Figure 2: Associate Comorbidity**

Figure 2 shows that associated comorbidities like N, HMD, BA, TTN, IUGR, Sepsis, NJ, CM, Convulsion and MAS noted in 62%, 9.3%, 7.3%, 5.3%, 4.7%, 2%, 4%, 3.3%, 2.7%, 0.7% and 0.7% participants respectively. Mean duration of KMC was 7.4 hours with 3.5 SD.

**Table 3: Comparison of mean weight, head circumference and length of group A and group B at the time of initiation of KMC, at discharge and follow-up [N=150]**

Parameter	At initiation of KMC	At Discharge	At follow-up	P value
Weight				
Group A	1.7 ± 0.11	1.7 ± 0.11	4.0 ± 0.3	0.0001
Group B	1.7 ± 0.11	1.7 ± 0.11	3.6 ± 0.4	0.0001
HC				
Group A	32.2 ± 1.1	32.2 ± 1.1	55.3 ± 2.7	0.0001
Group B	31.7 ± 1.4	31.7 ± 1.4	53.3 ± 1.9	0.0001
Length				
Group A	42.4 ± 1.2	42.4 ± 1.2	41 ± 1.3	0.0001
Group B	41.8 ± 1.3	41.8 ± 1.3	39.1 ± 1.5	0.0001

A repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean height, Length, Weight and Head Circumference value of group A differed statistically significantly between time points at initiation of KMC, at discharge and follow-up visit ( $P < 0.05$ ).

**Table 4: KMC at Home [N=50]**

KMC at home	Number	%
Given	35	70
Not given	15	30

Table 4 shows that KMC at home was given in 70% participants who came for follow-up.

**Table 5: Mean duration of KMC at home [N=150]**

Duration of KMC [in hrs]	
Mean ± SD	6.4 ± 2.3

Table 5 shows that mean duration of KMC at home was 6.4 hours with 2.3 SD.

**Table 6: INFANIB score [N=50]**

INFANIB score	Group A		Group B		P value*
	N	%	N	%	
Normal	34	68	12	24	
Transient	1	2	2	4	0.1
Abnormal	0	0	1	2	

\* Chi-square Test

Table 6 shows that normal, transient and abnormal INFANIB score was observed among 91.7%, 6.2% and 2.1% participants of group A and 24%, 4% & 2% of group B respectively. The difference between participants according to INFANIB score was statistically not significant ( $p>0.05$ ).

### Discussion

Low birth weight (LBW) is a significant issue all over the globe. One of the risk factors for neurodevelopmental delay is low birth weight. Early interventional treatment, touch therapy, tactile stimulation, bedding, and rooming are some of the therapies utilized to avoid the delay. Skin-to-skin contact is an important component of Kangaroo Mother Care (KMC), which is also known to enhance visual, auditory, taste, and smell senses.

In the current research, 78.7 percent of infants were successfully achieved exclusive breastfeeding at the time of discharge following initiation of KMC, compared to 7.3 percent prior to the study's inception. While 67.3 percent of newborns achieved exclusive breast feeding at the time of discharge in the research conducted by Gamit et al., only 12.5 percent of neonates were able to achieve exclusive breast feeding at the time of discharge, in the study conducted by Vohra A et al [11] which was lower than the current study and, in the study, conducted by Udani et al. 12, 95% of the infants were successful in establishing breastfeeding, which was higher than the current study.

In present study, mean age of babies at the time of enrolment was 1.8 days. The study conducted by Vohra A et al [51], Mean age of enrolment of neonates was 5.8 days, which was higher than the present study. Age of enrolment in Udani et al [12] was 5 days while in Ramesh S et al it was 3.3 days. In a study done by Worku B et al [13], the mean age of the babies at the time of enrolment was 10 hours for the Kangaroo group and 9.8 hours for the CMC group. In our study more than 95 percent of the babies were enrolled at the age of 24 hours. We found that Early enrolment of low-birth-weight babies in KMC has better outcome than babies with KMC started after stabilization. In present study Forty-nine (32.7%) of the care takers had continued to give KMC at home. The mean duration of KMC given at home was 6.4 hours. As per WHO, KMC to LBW babies should be given as much as possible. Kangaroo mother care provides effective thermal control and may be associated with a

reduced risk of hypothermia. In low-birth-weight infants, muscle activity and non-shivering thermogenesis are either limited or non-existent. In current study hypothermia was prevalent among 4 LBW babies (2.6%) before initiation of KMC, while 2 participants (1.3%) had developed hypothermia after initiation of KMC. In research conducted in Nepal, Kanodia et al [14]. Found that 2.6% babies having hypothermia which decrease to 1.3% after initiation of KMC which were similar findings to our study. In the study done by Vohra A et al [11], Hypothermia was observed in 3 (0.2%) neonates after initiation of KMC. Hypoglycemia was discovered in five (3.3%) LBW babies before initiation of KMC which was reduced to only one (0.6%) after initiation of KMC. In a study done by Suman et al [15], in Bangalore where they found 29 babies (5.8%), significantly higher number in the conventional care group suffered from hypoglycemia. Similarly, Udani et al [12], reported that KMC at birth prevented hypoglycemia in preterm as well as term neonates.

In current study apnea was discovered in five (3.3%) LBW babies before initiation of KMC and after starting KMC no babies were developed apnea. According to research conducted by Vohra AS et al [11], apnea was present in 2.4 percent of newborns before to the introduction of KMC, but it was substantially reduced following the introduction of KMC. LBW, whether preterm or SGA, are more susceptible to infection than the general population owing to a defective humoral and cellular immune system, as well as inefficient immunologic responses to infection. [16] Before starting of KMC, sepsis was diagnosed in 6 (4%) LBW babies in present research while one (0.6%) babies had developed sepsis during KMC. According to the findings of a Cochrane meta-analysis, KMC was linked with a decrease in nosocomial infections and sepsis. The use of intermittent KMC substantially reduced the risk of severe sepsis in infants. [17] When applied topically, KMC promotes skin barrier function and may act as an occlusive agent, which helps to reduce the risk of nosocomial infections in hospitalized patients.

In our research, there was a significant weight gain at the 3 month of follow up in both groups who were giving KMC at home and who were not giving KMC at home, but who continue KMC at home having higher growth in between 50th to 95th

centile and who had not continue KMC at home having lower growth in between 3rd to 50th centile in standard who growth chart according to age of the babies. [13] The results of a study conducted by Mazumder et al [18]. showed that LBW who got KMC had better growth.

The INFANIB was developed by Ellison and is intended to provide information on age-specific motor development impairment throughout infancy [19], It was designed to provide information on age-specific motor development impairment during the first 18 months of life and to identify infants who would benefit from early intervention. In present study, 68% of the babies who had continued KMC at home were having normal INFANIB score. Among 4% and 2% of the babies who had not continued KMC at home were having transient and abnormal INFANIB score respectively. Although there is no significantly difference between two groups. According to a study conducted by Vohra AS et al [11], at 6 month follow up, 25 percent of neonates in the Group who received KMC had transient and abnormal INFANIB, compared to 38 percent of neonates in the Group who did not receive KMC, with a p value less than 0.05; this suggests that KMC has an effect on the maturation of the brain.

Limitation of the study was: Study was not randomized control trial as it was followed up cohort study. Study only include LBW neonates admitted in Special neonatal intensive care unit while excluding neonate admitted in post-natal ward and home visit as follow up was not possible because long distance as most of the neonates were refer from other district to civil hospital.

### Conclusion

KMC has significant role in growth improvement, exclusive Breastfeeding rate, decreasing morbidities, reducing the need of extra equipments, antibiotics, artificial milk and empowering the mother as primary care provider; KMC has major role in conserving the scarce resources and personnel in limited resources area.

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