

Effect of Kangaroo Mother Care on Heart rate, Respiratory rate and Temperature in Low Birth Weight Babies

Verma P¹, Verma V²

¹Dr Pramila Verma, Assistant professor, Department of paediatrics, Peoples college of Medical Sciences, Bhopal, India, ²Dr Vijay Verma, Department of Radiodiagnosis, Gandhi Medical College, Bhopal, India

Address for correspondence: Dr. Pramila Verma, Email: drpramilav@yahoo.com

Abstract

Background: Kangaroo mother care (KMC) involves skin-to-skin positioning of the infant in an upright position against the mother's chest. The two other components of KMC are frequent and exclusive breastfeeding (where possible) and early discharge from hospital. Aim of present study was to assess effect of kangaroo mother care on heart rate, respiration rate and temperature of low-birth weight preterm newborns admitted in a tertiary care centre of central India. **Methods:** Low birth weight babies (weighing < 2000 grams) were given kangaroo mother care (KMC) for 30 minutes. Pre and post KMC heart rate, respiratory rate and temperature were measured. The evaluations were done once a day, for three consecutive days and the mean values were taken for analysis. The data was statistically analyzed using plus 6.0 statistical software. Student t test was used to find out the statistical difference between two mean SD. **Results:** Results of the study reveal that changes in heart rate and respiration rate after application of kangaroo care was insignificant ($p > 0.05$) where as kangaroo care is highly effective in maintaining skin temperature ($p < 0.0005$). **Conclusion:** KMC maintains heart rate, respiratory rate and temperature in a stable preterm low birth weight babies.

Key words: Kangaroo care, KMC, Heart rate, LBW

Introduction

Low birth weight for our country is a serious public health problem and contributes to high neonatal mortality. According to the report published in Lancet almost all (99%) neonatal deaths occur in low income and middle-income countries [1, 2]. In India around one million babies die each year before they complete their first month of life, contributing to one-fourth of the global burden [1, 3]. Prematurity is one of the common causes of neonatal deaths in developing countries like India. These neonates need special care as they have several handicaps, the most important being maintenance of body temperature. To overcome this problem kangaroo care was introduced in Bogota, Colombia, more than 25 years ago as one component of an alternative approach to traditional neonatal intensive care unit (NICU) care for low-birth weight infants [4]. Kangaroo mother care (KMC) is the practice of skin-to-skin contact between an infant and parent. Since then lot of research work on kangaroo care has been done globally.

These studies clearly depict advantages of kangarooing like weight gain in KMC babies, increased breast milk secretion and early discharge from NICU [5].

However, the effect of kangaroo care on physiological parameters is still controversial. Scanty research article is available on the effect of KMC on physiological variables [6-11]. Kangarooing promotes closeness of mother and baby making the baby to relax thus stabilizing heart rate and respiration rate of the baby. Based on this hypothesis we planned this observational study in a teaching hospital of central India. Thus the aim of our study was to determine the effect of kangaroo mother care on heart rate, respiratory rate and temperature in low birth weight babies

Materials and Methods

This hospital based observational study was conducted over the period of one year. Preterm babies weighing <2000 grams who got admitted in the NICU of pediatric department were included in the study. Included preterm babies were not having any neurological, cardiac and /or respiratory deficiencies. Babies with major congenital

anomalies were also excluded from the study. There were 514 infants admitted during the data collection period. Of those 251 meeting the selection criteria, 138 were approached, 89 accepted to participate giving a refusal rate of 36 percent. So total 89 preterm babies were enrolled for the study. Out of these 89 babies, 9 babies were further excluded from the study because their mother refused to continue participating in the study after one day of kangarooing. Remaining 80 babies were enrolled for the study.

Kangarooing was provided to these babies from day one of delivery /admission to NICU or from the time they stabilized. KMC was done by the mother either in NICU or the adjacent room provided to mothers.

Mothers were doing kangarooing by either sitting on reclining chair or lying down on the hospital bed with the head rest raised to 45°.

Assessments were made before and after 30 minutes of kangaroo mother care daily for 3 consecutive days. Pre KMC heart rate (HR), respiratory rate (RR) and temperature was recorded just before starting KMC. Pre KMC measurement was done while newborn was on warmer or lying down on a cradle. Post KMC assessments were made

Results

Out of 80 babies 46 babies were male and only 11% of the newborn were extremely LBW.

Table 1: Distribution of the newborn included in the study

Weight at birth (grams)			Gestational age (weeks)					
<1200	1201-1800	1801- 2000	27- 28	29- 30	31-33	34-36	AGA*	SGA*
6	39	35	5	15	21	39	63	17
11%	45%	43%	6%	18%	26%	48%	78%	22%

*AGA-appropriate for gestational age

*SGA small for gestational age

Majority of the babies were above 1200 grams and two third of the babies were above 30 weeks (Table-1). Substantial numbers (78 %) of the babies were appropriate for gestational age while only 22% of babies were small for gestational age.

Table 2: Various parameters of the newborn included in the study

Mean Birth weight (gm)± SD	Mean gestational age (weeks)	Mean age#	Male: female ratio
1631.28 ± 290 .86	32.18	9.15 days of life	1.3:1 (46/34)

Age when kangaroo started

Mean gestational age of babies was 32.18 weeks and mean birth weight was 1631.28 ± 290.86 grams (Table-2). Mean postnatal age was 9.15 days of life when KMC was initiated. Male 46(57.5%) babies outnumbered female babies.

after 30 minutes of kangarooing. The evaluations (respiratory rate, heart rate and temperature measurements) were done once a day, for three consecutive days and the mean values were taken for analysis.

For these evaluations a pulse oximeter (Stellar pulse rate monitor, manufactured by L& T limited Mysore, India) and a mercury thermometer were utilized. The first assessment was done for breathing movements by counting the respiratory rate over one minute.

Next measurement was done for heart rate. For that a sensor was placed on the sole of the newborn’s right toe and then heart rate was noted down. In the last the skin temperature was measured by keeping thermometer beneath the baby’s axillary folds for three minutes.

The babies were fed one hour prior to starting Kangaroo Care. Most of the babies slept during Kangaroo Care and appeared relaxed.

Participation was voluntary and the mothers were allowed to withdraw from the study at any time. Informed consent was taken from all the mothers participating in the study.

Table 3: Vital signs measured before and after 30 minutes of kangarooing

Vital signs	Mean	SD	t-value	p-value
HR/minute Before KMC	140.48	12.46	0.0968	0.9230
After KMC	140.66	12.04		
RR/minute Before KMC	41.44	8.53	0.4423	0.6589
After KMC	40.86	7.9		
Temp Before KMC	34.69	1.45	13.983	<0.0001
After KMC	36.97	0.412		

HR-Heart Rate, RR- Respiratory Rate, Temp -Temperature measured over 3 minutes

Mean heart rate before starting KMC was 140.48/minute and after 30 minutes of kangarooing HR was 140.66/minute. Mean RR before starting KMC was 41.44/minute and after accomplishment of KMC means RR was 40/minute. These findings were statistically insignificant (Table-3).

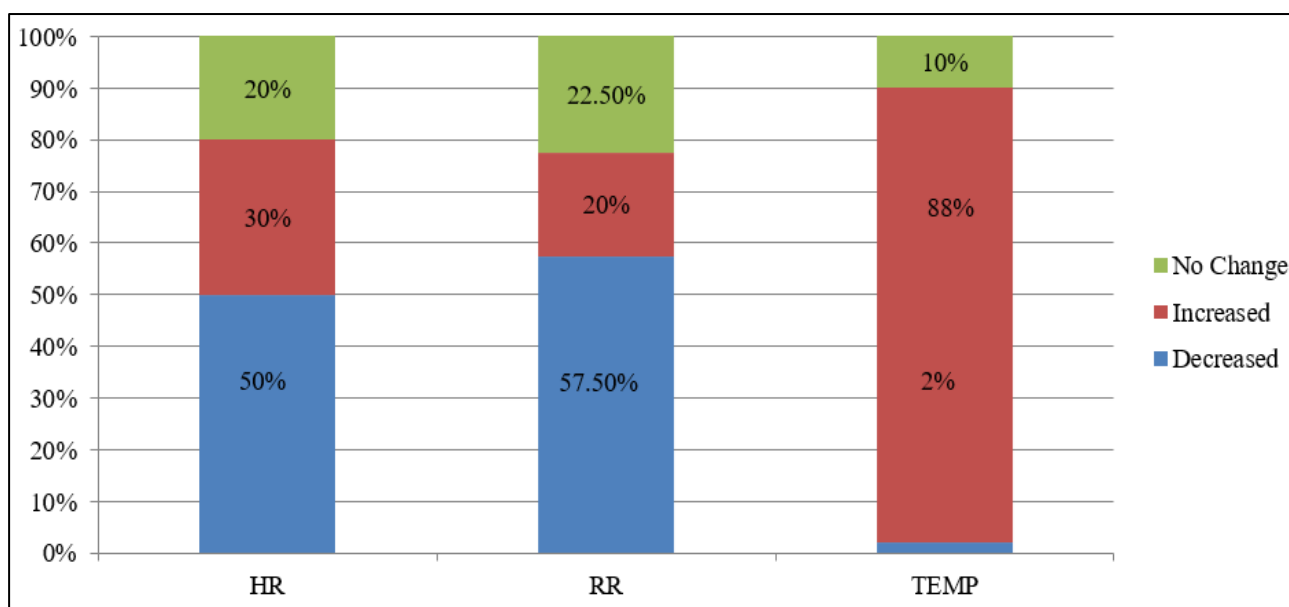


Figure 1: Showing percentages of babies with variation in vital signs

Table 4: Changes in heart rate Pre and Post KMC

Group	Newborn	Range	Mean ± SD	Decreased	Increased	No change
I	6	-7 to +5	1.5±5.6	3 (50%)	2(33%)	1(17%)
II	39	-8 to +5	-0.4±3.4	20(51.28%)	7(18%)	12(30.7%)
III	35	-6 to +5	-0.17±3.5	17(49%)	15(43%)	3(8%)
Total	80	-8 to +5		40 (50%)	24(30%)	16(20%)

In 50% of babies heart rate was decreased after kangarooing while HR was increased in 30% of babies. No change was noticed in the HR of 20% of babies after half an hour of kangarooing (Table-4). Maximum gain in heart rate was 5 beat/minute whereas maximum fall in heart rate was 8 beats\ minute. Changes in heart rate were within normal limit and they were statistically insignificant.

Table 5: Changes in respiratory rate Pre and Post KMC

Group	No. of infants	of Range	Mean ± SD	Decreased	Increased	No change
I	6	-6 to +1	-3.5±3.15	4(66.67%)	1(16.67%)	1(16.67%)
II	39	-3 to +2	-2±2.16	22(56.41%)	6(15.38%)	11(28.2%)
III	35	-5 to +5	-0.6±2.9	20(5.14%)	9(26%)	6(17%)
Total	80	-6 to +5		46(57.5%)	16(20%)	18(22.5%)

Table -5 Shows that 57.5% of babies showed decreased RR. Alterations in respiratory rate were within normal limit. No change in RR was seen in 22.5% of babies after half an hour of kangaroo care. All the changes were statistically insignificant. Maximum increase in RR was 5/minutes whereas maximum decrease in RR was 6/minute.

Table 6: Change in skin temperature Pre and Post KMC

	Before KMC No. of neonates	After KMC No. of neonates
Normothermic *	12 (15%)	77(96.2%)
Hypothermic #	66 (82.5%)	2(2.5%)
Hyperthermic \$	2(2.5%)	1(1.2%)

Temperature was measured by keeping mercury thermometer over axilla of newborn for 3 minutes.

*skin temperature 36.5--37.5 °C

#skin temperature < 36.4.0°C

\$skin temperature > 37.6 °C

It is evident from Table-6 that before KMC 82.5% of babies were hypothermic but after KMC 96.2% babies became normothermic within half an hour which was found highly significant (p-value <0.0001).

Discussion

Our results show that heart rate either increased by 5 beats/ minute or decreased by 8 beats/ minute within normal limit; however, this finding is not statistically significant. In the current study decrease in mean HR were of greater magnitude than increase in HR.

This can be explained by the fact that babies, both preterm and full-term, cry less when placed in skin to skin contact with their mothers. Kangarooing also increases sleep time, as well as time spent in quiet sleep [12].

Decreased crying means less stress and subsequently lower levels of cortisol. Randomized controlled trial done by mooncey et al on stable premature infants have shown reductions in cortisol levels by 60% or more under the influence of 20 minutes or more of Kangaroo care when compared with infant left in an incubator [13].

During KMC the c-afferent nerves of the mother’s and infant’s chest surfaces respond to the pleasing human touch of KMC and send the pleasing touch message straight to the insular cortex of the limbic area of the brain. Upon pleasing touch stimulation, oxytocin is released within the brain and travels along neurons to 14 different areas of the brain.

The first target is the brain stem where oxytocin immediately calms and stabilizes cardio-respiratory variables as the brain stem shifts from sympathetic (stress, hyper alertness and reactivity, sense of threat) to parasympathetic (relaxation, calm, contentment, safety) control. The increase in the heart rate may occur because of the change in the newborn’s body position from supine to vertical and the handling, which leads to increased stress for the newborn. Heart rate may rise by 5-10 beats per minute during kangarooing rising initially in response to the head

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tilting upward and later due to infant warming [14,15]. Some researchers reported no or minimal change in heart rate during KMC. Whereas others reported increased heart rates within normal limit [16]. The findings of the study revealed that respiratory rate either increased by 5/ minute or decreased by 6/ minute during KMC which was within normal limit having no statistical significance. A possible explanation for the decreased respiratory rate is based on the upright position of the infant.

This method allows the infant to be held in a ventral position at an angle of ~ 60 degrees which decreases the compression of the diaphragm. Ventilation and perfusion are gravity dependent, so an upright position optimizes respiratory function. However, the heart and breathing rates are uncertain data, because the mother's respiratory and cardiac patterns may be superimposed on the newborn.

Research done by Fohe et al showed that respiratory rate was significantly decreased during kangaroo care whereas results of Tonhage CB and Fischer CJ are suggestive of minimal change during kangaroo mother care [17-19].

The results of our study regarding temperature control during KMC are consistent with various previous research and showing that KMC is highly favorable to newborn in controlling body temperature ($p < 0.0001$) [1, 14, 17]. A mother has actual "thermal synchrony" with her infant. When a baby is placed in the kangaroo position, skin to skin with his mother, the temperature of the mother's breasts actually change so that her baby can better maintain his own temperature. If the baby gets too cold the mother's body temperature will actually warm up one degree to aid warm the baby [14]. If the baby gets too hot, the mother's body temperature will decrease one degree to cool the baby. This even works when twins are kangarooed [15].

This has been proved by various studies that in an upright prone position babies tolerate noise and activity around them much better [20].

Furthermore, the flexed position that the baby assumes on his mother's chest as opposed to lying on his back in an incubator is a more efficient position for conserving heat.

The extra sleep that the infant gets snuggling with mom and the assistance in regulating body temperature helps the baby conserve energy and redirects calories expenditures toward growth and weight gain. In short it can be stated that Kangarooing provides relief from tense NICU milieu, enhances bonding and eases physiologic transitions.

Conclusion

This study concludes that Kangaroo method produces little variation in heart rate and respiratory rate that also within normal limit with optimum temperature control. Further

randomized controlled trials are required to find out the effect of kangaroo mother on heart rate and respiratory rate.

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