Research Article

Effect of Daily Intermittent Kangaroo Mother Care on Vital Physiological Parameters of Low Birth Weight Newborns

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Abstract

Objective: To determine the effect of daily intermittent Kangaroo Mother Care (KMC) on vital physiological parameters of low birth weight newborns.

Methods: This Quasi-experimental study was conducted in the Department of Neonatal Paediatrics, King Edward Medical University / Mayo Hospital Lahore from July 2017 to March 2018. Total of 84 low birth weight (< 2500gms) neonates were recruited by non-probability convenient sampling. Kangaroo mother care was provided for 3 consecutive hours a day, for 3 consecutive days. Vital physiological parameters including temperature, heart rate, respiratory rate and oxygen saturation of every baby were recorded immediately before and after KMC. Data was analyzed through SPSS 20.0. Median values of all four vital parameters (pre and post KMC) were compared by Wilcoxon signed-rank test after applying Kolmogrov-Smirnov test for normality distribution.

Results: In 84 newborns, there was no change in median body temperature after KMC on day 1, while it was + 0.25 0C on day 2 and + 0.4 0C on day 3(p-values < 0.001). There was no change in median respiratory rate after KMC on day 1 (p-value = 0.412), while it reduced by 2 breaths/min on day 2 (p-value = 0.01) and 2 breaths/min on day 3 (p-value < 0.001). There was no change in median heart rate after KMC on day 1 (p-value = 0.765), but it decreased favorably by 5 beats/min (p-value = 0.008) and 4 beats/min (p-values< 0.001) on day 2 and 3 respectively. The median oxygen saturation after KMC increased by 1% on all 3 days (p-values < 0.001).

Conclusion: Except respiratory rate and heart rate on day 1, all vital physiological parameters in low birth weight babies showed statistical improvement after KMC.

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Key Words: Kangaroo mother care, Low birth weight, Neonate, Vital physiological parameters, temperature, heart rate, respiratory rate, oxygen saturation.

Introduction

Low birth weight-LBW (weight < 2500gms) is an important factor contributing to neonatal and infant mortality[1]. The UNICEF-WHO estimates indicate that one out of every seven live births, 20.5 million births globally suffer low birth weight. Almost fifty percent of them being in Southern Asia. Prevalence of low birth weight varies across regions ranging from 7.2% in developed countries to 17.3% in Asia[2]. In underdeveloped countries, LBW neonates face nearly four folds higher risk of death than those having normal birth weight[3]. In India 16.4% live born babies are LBW[4]. While in Pakistan 22% babies amongst those whose birth weight is known, are born with low birth weight[5]. For babies who are

born preterm or with low birth weight, poor self control of body temperature and resulting hypothermia is a world wide issue irrespective of climates and has been linked to many complications and even death[6]. Hypothermia is also associated with abnormal heart rate in low birth weight babies[7].

Kangaroo mother care (KMC) has gained attention as a non-conventional cost-effective technique in neonatal care that aids in giving warmth, touch stimuli and secure feelings to neonate. KMC involves placing the newborn baby in direct skin contact with mother's chest and abdomen along with frequent breast feeding. KMC has shown promising results in terms of improved weight gain and shortened NICU stay of neonates[8]. In low and middle-income countries, incorporation of KMC for LBW infants has also shown to reduce neonatal and infant mortality[9]. Recently WHO recommends that KMC should be the routine care for neonates weighing less than 2000 gms[10].

The direct intimate maternal skin contact with baby combined with nutritive sucking is thought to evoke neurophysiological and psychological responses in newborn. As evident that during KMC baby feels mother's heart sounds, periodic breathing movements, warmth and experiences upright positioning. This can have a calming effect on newborn leading to stabilization of physiological parameters[11]. There is very little data that has evaluated the impact of intermittent KMC on vital physiological parameters of LBW newborns in the developing countries' context, when used intermittently. The objective of this study was to determine the effect of intermittent daily Kangaroo mother care on vital physiological parameters like body temperature, respiratory rate, heart rate and oxygen saturation of low birth weight newborns. We hypothesized that Kangaroo mother care is effective in maintenance of normal body temperature in LBW babies and in stabilizing respiratory rate, heart rate and oxygen saturation.

Methods

Institutional review board of King Edward Medical University approved the study *(IRB no. 17/RC/KEMU dated 15/7/2017)*. This Quasi-experimental study was conducted in the Department of Neonatal Paediatrics, King Edward Medical University / Mayo Hospital Lahore from July 2017 to March 2018. Sample size of 84 neonates was estimated by using 95% confidence interval, with expected pre and post KMC heart rate as 141.3 ± 9.92 and 145.9 ± 7.77 respectively, with power of 98%.18 Neonates with the birth weight of < 2500 grams (low birth weight) with stable general condition were recruited by non-probability convenient sampling. Babies with major congenital anomalies, those having features consistent with any syndrome and those having unstable general condition were excluded.

The mothers of low birth weight babies were counseled about breast feeding (BF), KMC. Techniques of BF and KMC were verbally explained and visually demonstrated by volunteer mothers. Formal informed written consent was obtained from mothers for participation in the study. Study variables included age, sex, gestational age, weight, place and mode of delivery, type of feeding, vital parameters including heart rate, respiratory rate, oxygen saturation and body temperature. Kangaroo mother care was provided using a customised KMC bag. Baby was placed in direct close skin to skin contact with mother's bare chest and abdomen while baby wearing cap, socks and diaper only. Baby's head was turned to one side in slightly extended position while hips flexed and abducted in frog like posture. Heart rate was recorded with pulse-oximeter in beats per minute while respiratory rate was counted directly by recording abdominal movements for one minute. Temperature was recorded by digital thermometer in Celsius by placing in axilla for one minute. Oxygen saturation was recorded with pulse-oximeter in percentage. Baby was allowed to breast feed as often as he/she wanted. KMC was given for 3 consecutive hours at a time, for 3 consecutive days. Temperature, heart rate, respiratory rate and oxygen saturation were recorded immediately before and after KMC for 3 consecutive days. All results were recorded using a predesigned performa.

Data was analyzed through SPSS 20.0. Quantitative variables (age, gestational age, birth weight, OFC, heart rate, respiratory rate, temperature and oxygen

saturation) were summarized as median and inter-quartile ranges (IQR: 25th percentile-75th percentile). Qualitative variables (sex, place and mode of delivery, type of feeding) were summarized as frequency and percentages. Median values of all four vital physiological parameters before and after KMC were compared by Wilcoxon signed-rank as the data was skewed according to Kolmogrov-Smirnov test for normality. P-value of < 0.05 was considered statistically significant.

Results:

Of the 84 LBW babies, 53 (63.1%) were males and 31 (36.9%) were females. The median age at inclusion in study was 7 (4-13.75) days. Median gestational age was 35 (33-37) weeks. The median birth weight was 1900 (1500 – 2075) grams and median OFC recorded was 31.9 (30-33) centimeters. of these babies, 62 (73.8%) were born in hospital and others at home. Twenty eight (33.3%) were delivered by C-section. During KMC intervention 55 (65.5%) were on exclusive breast feeding, 4 (4.8%) were on formula feed while remaining 25 (29.8%) were on mix feeding.

The median body temperature of babies after KMC changed from 98.0 (97.6-98.0) ^{0}C to 98.0 (98.0-98.6) ^{0}C on day 1, from 98.0 (97.8-98.0) ^{0}C to 98.25 (98.0-98.6) ^{0}C on day 2 and from 98.0 (97.8-98.0) ^{0}C to 98.4(98.0-98.6) ^{0}C on day 3 (p-values < 0.001 for each of three days). The median respiratory rate on day 1 was 52 (48-58) breaths/minute which after 3 hours of KMC remained same 52(50-56) breaths/minute (p-value = 0.412). On day 2 the median respiratory rate was 52 (48-54) breaths/minute which reduced to 50 (46-54) after KMC (p-value = 0.010). On day 3 the median respiratory rate was 52 (48.5-56) which reduced to 50 (47.25-54) breaths/minute after KMC (p-value < 0.001). The median heart rate on day 1 was 131(120-140) beats/minute which remained after KMC as 131(122-141.5) (p-value = 0.765). While the median heart rate on day 2 was 135(125-140) beats/minute which reduced after KMC to 130 (122-135) (p-value = 0.008) and on day 3 median heart rate was 132.5 (123.25-142) which reduced after KMC to 128 (120-136) beats/minute (p-value < 0.001). The median oxygen saturation increased from 95(93-96) percent to 96 (94-97.75) percent on day 1, from 95.5 (94-96) to 96 (95-98) on day 2 and from 95 (93.25-96) to 96 (95-98) on day 3 after KMC (p-values < 0.001 for each of three days). (Table I, Fig. I-II)

Table I: Vital Parameters Before and After KMC

N=84

Vital signs	Day 1			Day 2			Day 3		
	Before	After	P-value	Before	After	P-value	Before	After	P-value
Temperature Median(IQR)	98.0 (97.6-98.0)	98.0 (98.0-98.6)	<0.001	98.0 (97.8-98.0)	98.25 (98.0-98.6)	<0.001	98.0 (97.8-98.0)	98.4 (98.0-98.6)	<0.001
Respiratory rate Median(IQR)	52 (48-58)	52 (50-56)	0.412	52 (48-54)	50 (46-54)	0.01	52 (48.5-56)	50 (47.25-54)	<0.001
Heart beat Median(IQR)	131 (120-140)	131 (122-141.5)	0.765	135 (125-140)	130 (122-135)	0.008	132.5 (123.25-142)	128 (120-136)	<0.001
Oxygen saturation Median(IQR)	95 (93-96)	96 (94-97.75)	<0.001	95.5 (94-96)	96 (95-98)	<0.001	95 (93.25-96)	96 (95-98)	<0.001

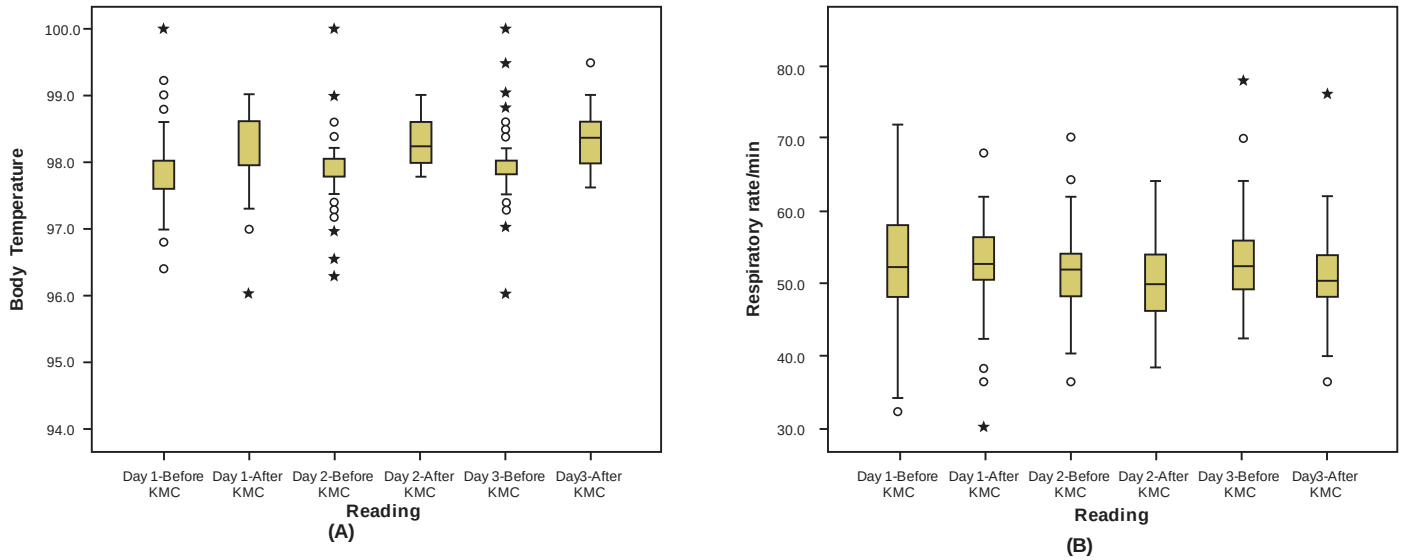

Figure 1: *(A) Box plot presenting body temperature before and after KMC for 3 days; (B) Box plot presenting respiratory rate before and after KMC for 3 days.*

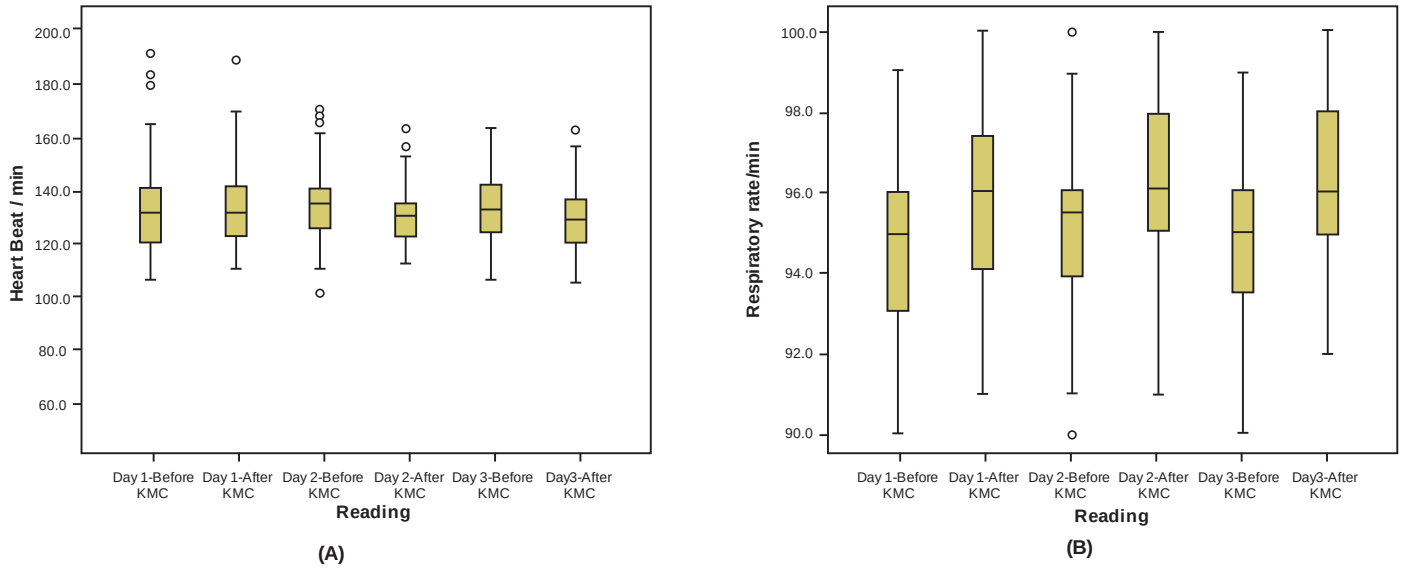

Figure 2: *(A) Box plot presenting heart beat before and after KMC for 3 days; (B) Box plot Presenting oxygen saturation before and after KMC for 3 days.*

Discussion:

Our study shows that median body temperature of LBW newborns increased statistically after KMC on all three days. Astuti et al found KMC as effective in maintaining body temperature of low birth weight babies as use of incubators[12]. Verma et al in their study relating temperature maintenance during KMC have also shown that KMC is highly efficient in maintaining body temperature of newborn babies[13]. Dehghani K et al and Parisa et al also found KMC to be superior than conventional newborn care in maintaining body temperature with significant p-value of < 0.05, the findings similar to our study[14,15]. Chan et al were able to show 36% reduction in neonatal mortality and decrease in risk of hypoglycemia and hypothermia among preterm and low birth weight babies when subjected to kangaroo mother care[16].

Except for day 1, median reduction in respiratory rate was statistically significant though remained within normal clinical limits on all three days. This may suggest a soothing effect of KMC on the respiratory drive. The results from Verma et al showed that respiratory rate either showed a rise by 5/ minute or fall by 6/ minute during KMC which remained within normal range having no statistical significance[13]. Study by Dehghani et al also did not show any

significant effect of KMC on respiratory rate of newborns[14]. A possible reason for the decrease in respiratory rate is related to upright position of the baby. Shah et al also found that direct skin to skin contact of neonate with mother helps in keeping baby in quiet sleep with stable low heart rate, less frequent apnea, stable body temperature and improved blood oxygenation[17]. While Swarnkar et al found KMC very effective in preventing apnea (p-value 0.007) and hypothermia (p-value 0.0001) in low birth weight newborns as compared to babies in conventional newborn care, results being similar to ours.18 Nourian et al and Parisa et al also found KMC helpful in decreasing respiratory rate of LBW babies when subjected to KMC[19,15].

Except for day 1, when median heart rate showed no clinically and statistically significant change, it showed favorable reduction on other days. Similarly, Verma et al show increase in heart rate by 5 beats/ minute or decrease by 8 beats/ minute, results remaining within normal limits having no statistical significance[13]. Dehghani et al did not find any statistically significant difference in heart rate of babies while subjected to KMC possibly due to shorter duration of only one hour per day of KMC[14]. The significant difference in our study can be related to term or preterm, and lesser cry when babies were kept in close skin to skin contact with their mothers. Furthermore no significant effect of KMC on median respiratory rate and heart rate on day1 may be due to mother's first experience in KMC and she may not be confident enough to maintain good attachment and these parameters can change abruptly with mother's body movement. Results of Nourian et al and Parisa et al are consistent with ours in decreasing heart rate of newborns to stable lower limits while subjected to KMC[19,15].

In our study oxygen saturation also increased significantly on all three days and these results are consistent with those of Dehghani et al , Parisa et al, Shah et al and Nourian et al.[14,15,16,19] Bera et al also showed statistically significant improvement in mean oxygen saturation on all 3 days of KMC[20].

An additional benefit of KMC that was revealed in our study was establishment of successful breast feeding in larger proportion of babies. This might have been possible due to intimate baby-mother bonding, increased opportunity for baby to latch on mother's breast, supported by maternal confidence, psychological relaxation and enhanced milk let down reflex by direct close handling of baby. These results were in agreement with Ghojazadeh et al[21] and Casper et al[22] who have found KMC to be superior to conventional newborn care in terms of breast feeding initiation and enhancing maternal milk production as well.

Our study is amongst the first of its kind in regarding KMC in our local circumstances, evaluating all four vital parameters.

Conclusion:

Except respiratory rate and heart rate on day 1, all vital physiological parameters of LBW babies showed statistically significant improvement after KMC. Hence KMC can be used as a reasonable substitute to conventional incubators use in low birth weight newborn care.

Ethical Approval: Given
Conflict of Interest: The authors declare no conflict of interest
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References:

1. Vilanova CS, Hirakata VN, de Souza Buriol VC, Nunes M, Goldani MZ. The relationship between the different low birth weight strata of newborns with infant mortality and the influence of the main health determinants in the extreme south of Brazil. Popul Health Metrics. 2019;17(9):15.
2. UNICEF-WHO Low birth weight estimates: levels and trends 2000-2015. Geneva:World Health Organization; 2019.
3. Eshete A, Alemu A, Zerfu TA. Magnitude and risk of dying among low birth weight neonates in Rural Ethiopia: A community-based cross-sectional study. Int J Pediatr. 2019;2019:9034952.
4. Khan N, Mozumdar A, Kaur S. Determinants of low birth weight in India: An investigation from the National Family Health Survey. Am J Hum Biol. 2020;32(4):e23355.
5. National Institute of Population Studies (NIPS) [Pakistan] and ICF.2019.2017-18 Pakistan Demographic and Health Survey Key Findings. Islamabad, Pakistan, and Rockville, Maryland, USA:

NIPS and ICF [cited 2020 Aug 29]. Available from:https://dhsprogram.com.
6. McCall EM, Alderdice F, Halliday HL, Vohra S, Johnston L. Interventions to prevent hypothermia at birth in preterm and/or low birth weight infants. Cochrane Database Syst Rev. 2018;2018(2) :CD004210.
7. Knobel RB. Optimal body temperature in transitional ELBW infants using heart rate and temperature as indicators. J Obstet Gynecol Neonatal Nurs. 2010;39(1):10.
8. Rehman MO, Hayat S, Gul R, Waheed KAI, Victor G, Khan MQ. Impact of intermittent kangaroo mother care on weight gain of neonate in NICU: Randomised control trial. J Pak Med Assoc. 2020; 70(6):973-977.
9. Mazumder S, Taneja S, Dube B, Bhatia K, Ghosh R, Shekhar M, et al. Impact of community-initiated kangaroo mother care on survival of low birth weight infants: study protocol for a randomized controlled trial. Trials. 2017;18(1):262.
10. Vogel JP, Oladepo TO, Manu A. New WHO recommendations to improve the outcomes of preterm birth. Lancet Glob. Health. 2015;10(3):598-590.
11. Jefferies AL, Canadian Paediatric Society, Fetus and Newborn Committee. Kangaroo care for the preterm infant and family. Paediatr Child Health. 2012;17(3):141-143.
12. Astuti NY, Novita RVT. Kangaroo mother care affect stability vital signs of low birth weight babies. Int J Res Med Sci. 2020;8(2):1702-1705.
13. Verma P, Verma V. Effect of Kangaroo Mother Care on Heart rate, Respiratory rate and Temperature in Low Birth Weight Babies. Int J Med Res Rev. 2014;2(2):81-86.
14. Dehghani K, Movahed Z, Dehghani H, Nasiriani K. A randomized controlled trial of kangaroo mother care versus conventional method on vital signs and arterial oxygesaturation rate in newborns who were hospitalized in neonatal intensive care unit. J Clin Neonatol. 2015;4(1):26-31.
15. Parisa 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(6):89.
16. Chan GJ, Valsangkar B, Kajeepeta S, Boundy EO, Walls S. What is kangaroo mother care? Systematic review of literature. J Glob Health. 2016; 6(1): 010701.
17. Shah RK, Sainju NK, Joshi SK. Knowledge, attitude and practices towards Kangaroo mother care. J Nepal Health Res Counc. 2018;15(3):275-281.
18. Swarnkar K, Vagh J. Effect of kangaroo mother care on growth and morbidity pattern in low birth weight infants: J Krish Inst Med Sci Univ. 2016; 5(1):91-99.
19. Nourian M, Yalgha M, Yaghmaei F, Akbarzadeh AR, Heyderzadeh H. Compare the effect of KMC and traditional care on physiological measures of LBW. J of Nurs and Midwifery Faculty. 2009; 19(65):19-24.
20. 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(4) :245-249.
21. Ghojazadeh M, Hajebrahimi S, Pournaghi-Azar F, Mohseni M, Derakhshani N, Azami-Aghdash S. Effect of kangaroo mother care on successful breast feeding: A systematic review and meta-analysis of randomized controlled trial. Rev Recent Clin Trials 2019; 14(2):31-40.
22. Casper C, Sarapuk I, Pavlyshyn H. Regular and prolonged skin to skin contact improves short-term outcomes for very preterm infants: A dose-dependent intervention. Arch Pediatr. 2018; 25(8): 469-475.