

Kangaroo Mother Care as compared to conventional care for low birth weight babies

Düşük doğum ağırlıklı bebekler için Kanguru anne bakımının geleneksel bakımla karşılaştırılması

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ABSTRACT

Aim: To study the efficacy of Kangaroo mother care (KMC) as compared to conventional care for low birth weight babies.

Materials and Methods: A randomized controlled trial was done on 114 neonates, delivered at Jawaharlal Nehru Medical College (JNMCH) Aligarh India (March' 2006 to September' 2007) by vaginal route and weighing ≤ 1800 grams at birth –58 neonates received KMC for 6-8 hours/ day in 4-6 sessions while 56 neonates in control group received conventional care (radiant warmers, cots in warm room). Efficacy was measured in terms of effect on growth, physiological parameters, length of hospital stay, morbidity, mortality and exclusive breastfeeding rates.

Results: KMC and conventional groups were similar with regard to maternal and birth characteristics. Better weight gain per day (19.3 ± 3.8 g vs. 10.4 ± 4.8 g, $p < 0.001$), significant reduction in respiratory rate ($p < 0.001$), rise in rectal temperature and oxygen saturation ($p < 0.001$), shorter duration of hospital stay (13.7 ± 8.9 days vs. 15.0 ± 10.3 days), lower incidence of nosocomial sepsis (6.9% vs. 23.2% $p = 0.014$) and severe infection ($p = 0.003$) and higher exclusive breastfeeding rates ($p < 0.01$) were seen in infants receiving KMC. No statistically significant difference was seen between the two groups in terms of mortality.

Conclusion: Kangaroo mother care results in better weight gain, decreases the risk of serious infections and hypothermia, stabilizes physiological parameters, decreases the hospital stay, promotes breast feeding and has no adverse effect on growth and mortality in LBW babies.

Key Words: Kangaroo mother care, low birth weight babies, weight gain, hypothermia, nosocomial infection

ÖZET

Amaç: Düşük doğum ağırlıklı bebeklerde Kanguru anne bakımı (KAB) ile geleneksel bakımı karşılaştırmak

Gereç ve Yöntem: Randomize ve kontrollü olarak, JNMCH Aligarh'da vajinal yoldan, 1800 gramın altında olarak doğan 58'i günde 6-8 saat KAB alan, 56'sı geleneksel bakım (radyan ısıtıcı, ılık odada bakım) alan toplam 114 yenidoğan karşılaştırıldı. Etkinlik; büyümeye etki, fizyolojik durum, hastanede kalım süresi, morbidite, mortalite ve yalnızca anne sütü alma oranları ile ölçüldü.

Bulgular: Anne ve bebek özellikleri bakımından KAB ve geleneksel grup arasında fark yoktu. Kanguru bakımı alan çocuklarda daha iyi ağırlık artımı (19.3 ± 3.8 g ve 10.4 ± 4.8 g, $p < 0.001$), solunum hızında anlamlı azalma ($p < 0.001$), rektal ısı ve oksijen doygunluğunda yükselme ($p < 0.001$), hastanede daha kısa kalım süresi (13.7 ± 8.9 gün ve 15.0 ± 10.3 gün), ve düşük hastane enfeksiyonu insidansı (%6.9 ve %23.2, $p = 0.014$), düşük ağır enfeksiyon ($p = 0.003$) ve yüksek oranda yalnızca anne sütü alma ($p < 0.01$) saptandı. Mortalite bakımından iki grup arasında istatistiksel olarak anlamlı bir fark gözlenmedi.

Sonuç: Kanguru anne bakımı düşük doğum ağırlıklı bebeklerde daha fazla ağırlık artımı, ciddi enfeksiyon ve hipotermi riskinde azalma, fizyolojik ölçütlerde tutarlı düzenlilik, kısa hastanede kalım süresi, daha uzun süre yalnızca anne sütü ile beslenmeye yol açtı. Düşük doğum ağırlıklı bebeklerde KAB'nın büyüme ve mortalite üzerinde olumsuz bir etkisi gözlenmedi.

Anahtar Kelimeler: Kanguru anne bakımı, düşük doğum ağırlığı, büyüme, mortalite, enfeksiyonlar

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INTRODUCTION

Low birth weight (LBW) is a major problem worldwide with an average incidence of 18% globally and 33% in developing countries.¹ It is a major contributor to neonatal and infant mortality and morbidity with about 30 % of neonatal mortality related to it in developing countries.² Thus the care of such infants becomes a burden for health and social systems every where.

Traditionally, these infants born in hospital are kept in incubators/ radiant warmers/ warm room with open cots. Hospital neonatal intensive care of LBW babies is difficult in developing countries due to high cost, difficulty in maintenance and repairs of equipments, intermittent power supply, inadequate cleaning of instruments and shortage of skilled staff. Frequently and often unnecessarily incubators and radiant warmers separate babies from their mothers, depriving them of the necessary contact.³

Kangaroo Mother Care (KMC), first proposed in response to the shortages of staff and equipment in their hospital by Dr Martinez & Rey in Bogotá Columbia in 1978, was developed as a simple method of care for LBW infants. The term kangaroo is derived from practices similar to marsupial care, in which the infant is kept warm in the maternal pouch and close to the breasts for unlimited feeding.⁴ It provides an appropriate, affordable yet high quality care and can be implemented almost anywhere.

The present study compared the efficacy of Kangaroo mother care with the conventional care for LBW babies.

MATERIALS AND METHODS

In the Neonatal section of Department of Pediatrics, Jawaharlal Nehru Medical College (JNMCH), Aligarh, a prospective randomized controlled trial was performed on 114 neonates delivered by vaginal route with birth weight of 1.2-1.8 kg in collaboration with Department of Obstetrics and Gynaecology. Neonates delivered by caesarean section, with major life threatening congenital malformation, severe perinatal complication and parental refusal for KMC intervention were excluded from the study.

For all the eligible neonates, an informed written consent was obtained from the parents before enrollment and following characteristics were re-

corded - maternal profile like age, antenatal care (ANC) visits, multiple deliveries, risk for sepsis etc.; birth weight, length and head circumference; gestational age assessment using Ballard Score within 24 hrs of birth. The enrolled neonates were randomized by block randomization technique into KMC and control groups.

In the KMC group, the neonates were given skin-to-skin contact as soon as they became hemodynamically stable, between the mother's breasts in an upright position dressed with a cap, socks and diaper and supported in bottom with a sling/binder. Front open gowns were made available for the mothers and privacy was provided to them. Comfortable chairs and beds were provided to the mothers practicing KMC in the nursery and postnatal wards. Skin-to-skin contact was given for a minimum of 1 hr at a stretch and at least for 4-6 hrs/day, duration was gradually increased to as long as comfortable to the mother and baby. Skin-to-skin contact was continued at home after discharge from the hospital.

Neonates in the control group were given conventional care as per the needs (radiant warmers, open cots in warm room).

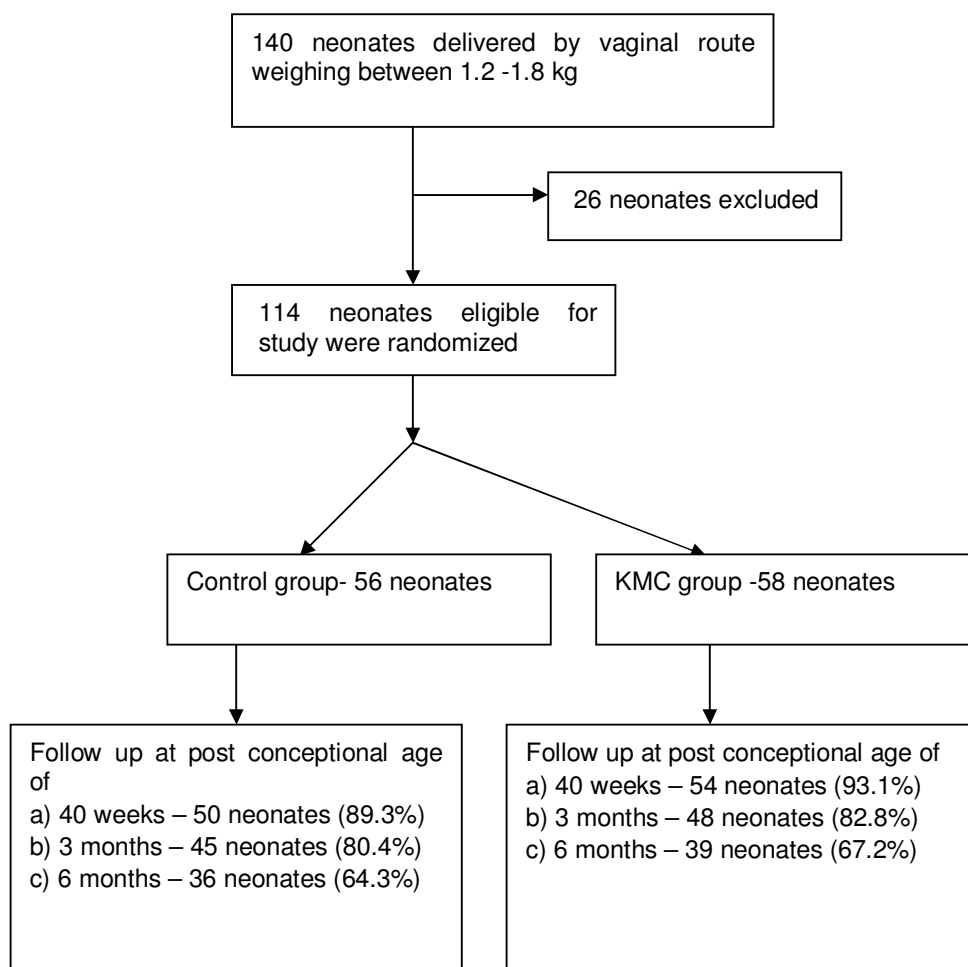
In both the groups, mothers were allowed to handle their babies at any hour of the day and breastfeed the babies by nasogastric tube, paladai or directly. Babies in both the groups were provided vitamin and mineral supplementation as per the protocol. The neonates were shifted to postnatal wards, once stable.

During hospital stay, both the groups were monitored for daily weight gain by electronic weighing scale; episodes of hypothermia, apnea, nosocomial sepsis, hyperbilirubinemia, necrotizing enterocolitis were noted; physiological parameters (heart rate, respiratory rate, rectal temperature and oxygen saturation) were measured at 0 and 1 hour of care by a single observer (mean of three readings) and duration of stay at hospital was recorded.

Infants in both the groups were discharged when demonstrated weight gain for at least 3 consecutive days, no overt illness, no IV medications and essentially on exclusive breast feeds. After discharge, the neonates were followed weekly till 40 wks of gestational age, fortnightly till 3 months of post-conceptual age and monthly visits thereafter till 6 months of post-conceptual age.

During follow-up, following characteristics were monitored in both the groups – anthropometry (weight by electronic weighing scale, length by infantometer and head circumference by non-stretchable tape as measured by a single observer); morbidity measured as mild/moderate (requiring oral antibiotics/no hospital admission) and severe (requiring IV antibiotics/hospital admission) infection; mortality and exclusive breastfeeding.

Statistical analysis: The data collected was statistically analyzed by computer using SPSS version 10 for windows. Tests of statistical significance used were chi-square test, z test, paired two-tailed t' test (for the physiological parameters). P value of <0.05 was considered as statistically significant.



RESULTS

A total of 140 neonates weighing between 1.2 – 1.8 kg were delivered by vaginal route during the study period of March' 2006 to September' 2007. 26 neonates were excluded due to congenital malformation, severe perinatal complication and parental refusal. Out of 114 neonates eligible for the study, 56 were randomized to the control group and 58 to the KMC group. Of these, 64.3 % and

67.2 % infants were followed till 6 months of post-conceptional age in the control and KMC groups respectively.

As shown in Table 1, the groups were similar with regard to the maternal profile and birth characteristics. There was no significant difference in the morbidity profile and the treatment received by the neonates before enrollment in the study.

The mean age at enrollment for the control and KMC group infants was 4.8 ± 2.4 and 4.7 ± 2.9

days respectively. Kangaroo mother care was given for a mean period of 6.3 ± 1.52 (4-12) hours/day by the mothers as observed during the hospital stay and was given for a period of 25.7 ± 6.9 (15-43) days after enrollment in the study.

KMC infants had a better weight gain per day than the control group infants during the hospital

stay (control: 10.4 ± 4.8 grams, KMC: 19.3 ± 3.8 grams $p < 0.001$). However no significant difference in the weight, head circumference and length was noted during follow-up at 3 and 6 months post-conceptual age.

Table 1. Demographic variables of control and Kangaroo mother care (KMC) groups

Demographic variables	Control (n=56)	KMC (n=58)	P
Maternal profile			
Age (years)	25.0 ± 3.69	25.3 ± 3.45	NS
Number of mothers (%) with			
-more than one risk for sepsis	33 (58.9%)	29 (50%)	NS
-meconium stained amniotic fluid	6 (10.7%)	5 (8.6%)	NS
-leaking per vaginam	12 (21.4%)	13 (22.4%)	NS
-antenatal visits	37 (66.1%)	44 (75.9%)	NS
-multiple deliveries	9 (16.1%)	8 (13.8%)	NS
Gravida			
G ₁	16 (28.6%)	21 (36.2%)	NS
G ₂	16 (28.6%)	10 (17.2%)	NS
G ₃	9 (16.1%)	12 (20.7%)	NS
G ₄	6 (10.6%)	4 (7.0%)	NS
G ₅	9 (16.1%)	11 (18.9%)	NS
Birth characteristics			
Mean GA (wks)	33.6 ± 2.29	33.1 ± 2.3	NS
Distribution of GA			
28-30 wks	3 (5.4%)	4 (6.9%)	NS
30-32 wks	9 (16.1%)	14 (24.1%)	NS
32-34 wks	21 (37.5%)	20 (34.5%)	NS
34-36 wks	17 (30.3%)	15 (25.9%)	NS
>36 wks	6 (10.7%)	5 (8.6%)	NS
Sex			
Male (%)	30 (53.6%)	29 (50%)	NS
Female (%)	26 (46.4%)	29 (50%)	NS
Mean birth weight (grams)	1615 ± 179	1607 ± 211	NS
Distribution of birth weight			
1200-1399 g	8 (14.3%)	11 (18.9%)	NS
1400-1599 g	15 (26.8%)	18 (31.1%)	NS
1600-1800 g	33 (58.9%)	29 (50.0%)	NS
Head circumference (cm)	29.0 ± 1.34	29.3 ± 1.53	NS
Length (cm)	41.9 ± 2.76	42.7 ± 2.16	NS
Appropriateness for GA			
AGA	49 (87.5%)	47 (81.0%)	NS
SGA	7 (12.5%)	11 (19.0%)	NS

AGA appropriate for gestational age, SGA small for gestational age, GA gestational age, NS not significant ($p > 0.05$)

Table 2 depicts the significant reduction in respiratory rate and increase in rectal temperature and oxygen saturation as was seen after 1 hour of kangaroo care compared to the conventional care.

Infants who received conventional care stayed longer in the hospital (15.0 ± 10.34 days) than the KMC infants (13.7 ± 8.9 days) but this difference was found to be statistically insignificant ($p = 0.233$).

Table 2. Physiological variables after 1 hr of KMC and conventional care

Physiological parameters	Control (n=56)	KMC (n=58)	P
	Mean±SD	Mean±SD	
Heart rate (rate/ min)	145.4±4.6	145.6±4.9	0.392
Respiratory rate (rate/ min)	45.5±4.9	37.1±3.8	<0.001
Rectal temperature (F)	98.2±0.2	98.6±0.1	<0.001
Oxygen Saturation (%)	92.1±1.5	93.6±1.6	<0.001

Table 3 illustrates that during the hospital stay, higher incidence of nosocomial sepsis, hypothermia and apnea was seen in the control group but no significant difference in the incidence of NEC was found. During follow-up, the incidence of severe infections was significantly higher in the control group though both the groups were found to be equally prone to mild/ moderate infections. The most common mild/ moderate infections seen were upper respiratory tract infections and diarrhea. Severe infections leading to hospitalization were pneumonia, diarrhea/ dehydration and sepsis.

Exclusive breast feeding was found to be more prevalent in the KMC group as compared to the control group. Proportions of infants who were exclusively breastfed were higher at 40 weeks (KMC: 94.4%, control: 72.0% p=0.002); 3 months (KMC: 89.6%, control: 62.2% p=0.002); 6 months post-conceptual age (KMC: 84.6%, control: 55.5% p=0.006) in the KMC group, the difference being statistically significant.

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Table 3. Morbidity profile after enrollment

Morbidity profile	Control n (%)	KMC n (%)	P
During hospital stay			
Sepsis	13 (23.2)	4 (6.9)	0.015
Hypothermia	10 (17.9)	1 (1.7)	0.003
Apnea	8 (14.3)	1 (1.7)	0.013
NEC	4 (7.1)	2 (3.4)	0.324
During follow-up			
Mild/moderate infect	43 (76.8)	41 (71)	0.460
Severe infection	10 (17.9)	3 (5.2)	0.033

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There was no significant difference between the two groups as far as mortality was concerned (p=0.705). Major causes of death were sepsis, NEC and pneumonia.

DISCUSSION

A randomized controlled trial was done in the Level III Newborn Infant Care Unit of a tertiary hospital in Aligarh for a period of one and half year. The demographic variables of the KMC and control group were comparable. The two groups received similar care except the KMC intervention.

The study showed significantly higher mean weight gain per day of KMC group infants during the hospital stay compared to the control infants. This is in accordance with observations made by Cattaneo et al, Charpak et al and Ramanathan et al.⁵⁻⁹ Better weight gain as seen in the infants receiving kangaroo care may be due to reduced energy expenditure, thus directing calories toward growth.

In the present study, no significant difference was seen between the groups regarding weight, head circumference and length at 6 months of post-conceptual age. This finding is in accordance with Sloan et al.¹⁰ However, Charpak et al.¹¹ found KMC infants had a larger head circumference than the control infants at 12 months of age.

A significant reduction in respiratory rate and increase in oxygen saturation was seen in infants receiving KMC. Acholet et al, Bauer et al, Fohe et al.¹²⁻¹⁴ and Kadam et al.⁴ also found higher oxygen saturation and reduction in respiratory rates after KMC. A possible explanation for the decreased respiratory rate, as well as the increased pO₂, is based on the upright position of the infant. Ventilation and perfusion are gravity dependent, so an upright position optimizes respiratory function.

Episodes of hypothermia were significantly reduced in the KMC infants and a higher rectal temperature was recorded. Bauer et al.¹³ Ludington et al and Ibe et al.^{15,16} also found the same in their studies. Placement of the infant underneath a blouse or shirt improved insulation and prevents heat loss during the maternal kangaroo care

Infants in the KMC group had a shorter duration of stay as compared to control group though this difference was not found to be statistically significant. This is in agreement with the observation of Charpak et al and Ramanathan et al.^{8,9} though they found a statistically significant decrease. Early discharge decreases the overcrowding in the neonatal units thereby reducing the chances of contracting hospital-acquired infection.

During hospital stay, nosocomial sepsis; episodes of apnea were significantly lower in KMC group as compared to control. The incidence of severe infection was significantly higher in the control group. This is in accordance with Whitelaw et al.¹⁷, Sloan et al.¹⁰ and Kadam et al.⁴

Our study recorded a higher proportion of exclusive breastfeeding among KMC infants. Charpak et al reported that the proportions of KMC mothers who breastfed up to 3 months (exclusively or partially) were significantly higher on statistical analysis.¹¹ Higher breastfeeding rates were also observed by Ramnathan et al.⁹

No statistically significant difference was observed in the mortality rates between the two groups. Similar results were obtained by Cattaneo et al and Charpak et al.^{5,8}

In conclusion, Kangaroo mother care is a feasible method of care for low birth infants once they have overcome major adaptation to extra-uterine life and it is at least as safe and effective as the conventional care.

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REFERENCES

1. World Health Organization. Essential newborn care. Report of a Technical Working Group, Trieste, 25-29 April 1994. Geneva: Maternal and Newborn Health/Safe Motherhood (WHO/FRH/MSM/96.13), 1996.
2. Charpak N, Ruiz-Palaez JG. Sources of resistance of KMC implementations in Developing countries and proposed solutions. Forum 9, Sep 2003.
3. World Health Organization. Kangaroo mother care: a practical guide. Department of Reproductive Health and Research, WHO, Geneva.2003.
4. Kadam S, Binoy S, Kanbur W, et al. Feasibility of kangaroo mother care in Mumbai. *Indian J Pediatr* 2005;72:35-38.
5. Cattaneo A, Davanzo R, Bergman NJ, Charpak N. Kangaroo mother care in low-income countries. *International Network in Kangaroo Mother Care. J Trop Pediatr* 1998;44: 279-282.
6. Suman RP, Udani R, Nanavati R. Kangaroo mother care for low birth weight infants: A randomized controlled trial. *Indian Pediatr* 2008;45:17-23.
7. Gupta M, Jora R, Bhatia R. Kangaroo mother care (KMC) in LBW infants- A western Rajasthan experience. *Indian J Pediatr* 2007;74:747-749.
8. Charpak N., Ruiz-Palaez J.G., et al. Kangaroo mother versus traditional care for newborn infants <2000 grams: A randomized controlled trial. *Pediatrics* 1997;100:682-688.
9. Ramanathan K, Paul VK, Deorari AK, Taneja U, George G. Kangaroo Mother Care in very low birth weight infants. *Indian J Pediatr* 2001; 68:1019-1023.
10. Sloan NL, Camacho LW, Rojas EP, Stern C. Kangaroo mother method: randomised controlled trial of an alternative method of care for stabilised low-birthweight infants. *Lancet* 1994; 344:782-785.
11. Charpak N, Ruiz-Palaez JG, Figueroa de C Z, Charpak Y. A randomized, controlled trial of kangaroo mother care: Results of follow-up at 1 year of corrected age. *Pediatrics* 2001;108: 1072-1079.
12. Acholet D, Sleath K, Whitelaw A. Oxygenation, heart rate and temperature in very low birth weight infants during skin-to-skin contact with their mothers. *Acta Paediatr Scand* 1989;78:189-193.
13. Bauer K, Uhrig C, Sperling P, Pasel K, Wieland C, Versmold HT. Body temperatures and oxygen consumption during skin-to-skin (kangaroo) care in stable preterm infants weighing less than 1500 grams. *J Pediatr* 1997;130:240-244.
14. Fohe K, Kroff CS, Avenarius S. Skin-to-skin contact improves gas exchange in premature infants. *J Perinatol* 2000;20: 311-315.
15. Ludington-Hoe SM, Hadeed AJ, Anderson GC. Physiologic responses to skin-to-skin contact in hospitalized premature infants. *J Perinatol* 1991;11:19-24.
16. Ibe OE, Austin T, Sullivan K, Fabanwo O, Disu E, Costello AM. A comparison of KMC and conventional Incubator care for thermal regulation of infants < 2000 g in Nigeria using continuous ambulatory temperature monitoring. *Ann Trop Pediatr* 2004;24: 245-251.