

ORIGINAL ARTICLE

Effect of Kangaroo Mother Care on Growth Parameters of Low Birth Weight Neonates

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ABSTRACT

BACKGROUND: To evaluate the effect of Kangaroo Mother Care(KMC) on growth parameters of low birth weight(LBW) neonates. **METHODS:** Prospective follow-up cohort study was carried out at NICU of Civil Hospital, Ahmedabad from 1 October 2014 to 30 June 2016 and details of neonates were recorded on prestructured proforma. **RESULTS:** Mean duration of KMC during the hospital stay was 9.3 ± 4.6 days (5.7 ± 2.4 hours/day). Mean weight gain, increment of Head circumference(HC) and Length in neonates receiving KMC less than 12 hours were 18.4 ± 4 gm /day, 0.68 ± 0.04 cm/week and 0.96 ± 0.09 cm/week, while mean weight gain, increment of HC and length in neonates receiving KMC more than 12 hours were 18.9 ± 3.6 gm/day, 0.7 ± 0.02 cm/week, 0.99 ± 0.04 cm/week. Better weight gain ($p=0.036$), increment in head circumference($p=0.016$) and length($p=0.021$) was noted with increase duration (more than 12 hours) of KMC. Weight gain, increment in head circumference are better in Preterm small for gestational age(SGA) (p value 0.005 and 0.01 respectively) as compare to Preterm Appropriate for gestational age(AGA), But no difference in increment in length noted in Preterm SGA($p=0.17$) than Preterm AGA. At 6 month follow up Weight gain, increment in head circumference and increment in length is better in neonate receiving KMC at home as compare to not received KMC at home ($p=0.009$, 0.002 and 0.004 respectively). **CONCLUSION:** Duration of KMC is the single most common determinant in intensifying the growth of LBW neonates. Better growth parameters are observed in extremely low birth weight(ELBW), very low birth weight(VLBW) & SGA neonates.

Key Words: KMC, Weight, HC, Length, Preterm, SGA

INTRODUCTION

Kangaroo Mother Care (KMC)^{1,2,3,4,5} is a special way of caring of low birth weight(LBW) babies carried out by skin-to-skin contact with the mother. It was developed by Dr. Edgar Ray Sanbaria & Dr. Martinezin Bogota, Colombia in 1978 as an alternative to inadequate & insufficient incubator care in developing countries but now considered as the most feasible, readily available, and preferred intervention for decreasing neonatal morbidity and mortality in developed and developing countries^{1,6,7}.

Key features of KMC are^{1,4,8}: Early, continuous and prolonged skin-to-skin contact, Exclusive breastfeeding & early discharge. It fosters infant health and

wellbeing by promoting effective thermal control, breastfeeding, growth & neuro-development, physiological stability, infection prevention, and infant-mother bonding; there by decreasing duration of hospital stay. It is also used as effective transport modality and analgesic for mild procedural pain^{1,9,10,11,12}. Present study was undertaken to evaluate the effect of KMC on growth parameters of preterm neonates and small for gestational age neonates (SGA).

MATERIAL AND METHODS

Prospective follow up cohort study was carried out in Neonatal Intensive Care Unit(NICU) of Civil Hospital, Ahmedabad from 1 October 2014 to 30 June 2016. Hemodynamically stable, intramural delivered babies with birth weight less than 2500 gm who were admitted in NICU were included in the study. Exclusion criteria: a) Unstable Neonates or critically ill neonates (b) Unwell mother and family members who were not ready to provide

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KMC, (c) Major malformation to baby, (d) LBW neonates brought to NICU from postnatal ward. KMC was provided in designed KMC chair or at fowler bed after counselling to KMC provider. Age at enrolment in the study, daily session and duration of each session, duration of KMC during the hospital stay and total duration of KMC were recorded in the pre-structured proforma. Neonates were weighed immediately after birth, at enrolment and daily till discharged with electronic weight scale. The length was measured at birth, at enrolment in study and weekly thereafter till discharge by using an infantometer. Head circumference (HC) was measured first after 24 hours of birth, at enrolment in study and weekly thereafter till discharge by standard method via measuring tape. Neonates were divided in 4 groups according to birth weight and the efficacy of KMC in each group was studied. : Group A – Birth weight (BW) < 1000 grams (ELBW neonates), Group B – Birth weight 1000 – 1499 grams (VLBW neonates), Group C – Birth weight 1500 – 1999 grams (LBW neonates), Group D – Birth weight 2000 – 2499 grams (LBW neonates).

Neonates fulfilling the discharge criteria were discharged from the hospital. At the time of discharge, KMC provider were reinforced to continue providing KMC at home. Enrolled neonates were followed up till 6 months of age. Neonates were divided into 2 groups. Group X: Received KMC at home, Group Y: Not received KMC at home. At 6 month of age – neonate weight, head circumference and length were measured, compare in both group. Statistical Analysis was done by Student ‘t’ test & ANOVA (taking 5 % level of significance), 2 tests for proportion(taking 5 % level of significance) & Chi square test. Statistical

Analysis done by graphpad calculator version 3.

RESULTS

There were 10622 intramural deliveries during the 18 month period, out of which 3274 neonates were LBW from which 576 neonates were enrolled. Out of 576 neonates, 154 neonates come for follow up visits out of which 96 had continued KMC at home for 6 months while other had stopped KMC before the completion of 6 months.

In study group 52% were female neonates, mean birth weight was 1511 grams, mean gestational age was 32.27 week and almost 90% neonates were preterm neonates. Mean age of enrolment, duration of hospitalization, duration of KMC during hospitalization were 5.8 days, 11.77 days and 9.28 days respectively. Mean hours of KMC were 5.7 ± 2.34 hours/day. Characteristics of the study group were shown in table no 1.

Table 1: Baseline characteristics of Study Group

Birth Weight in gram (n=576)		Distribution of LBW (n=576)		Gestational Age (n=576)	
< 1000	12	Preterm AGA	466	< 28 week	0
1000 – 1499	237	Preterm SGA	45	28 – 30 week	5
1500 – 1999	286	Preterm LGA	4	30 – 32 week	113
2000 – 2499	41	Full term SGA	61	32 – 34 week	281
Mean	1511 ± 287			34 – 36 week	91
				36 – 37 week	26
				> 37 week	61
				Mean	33.27 ± 2.62

Effects of KMC on growth parameters- weight, head circumference, and length respect to duration of KMC were summarize in table 2, 3 & 4. Effect of KMC on AGA, SGA, and LGA neonates are summarize in table 5. At 6 month follow up, Mean increment in weight, head circumference and length were 18.7 ± 3.9 gm/day, 0.68 ± 0.041 cm/week and 1.03 ± 0.12 cm/week in group X; while mean increment in weight, head circumference and length in group Y were 16.4 ± 3.2 gm/day, 0.64 ± 0.052 cm/week and 0.914 ± 0.09 cm/week. weight gain, increment in head circumference and increment in length were better in Group X as compared to group Y (p 0.009, 0.002 and 0.004 respectively). .

Table 2: Effect of KMC on weight of neonates according hours of KMC/day

Parameter	Group A B. W. <1000 gm (n=12)	Group B B. W. 1000-1500 gm (n=237)	Group C B. W. 1500-2000 gm (n=286)	Group D B. W. 2000-2500 gm (n=36)	Study Group (n=576)	ANOVA p value
Means hours of KMC/day	6.3±3.0	6.5 ± 3.04	5.16 ± 1.73	5.02 ± 1.9	5.7 ± 2.34	
Mean Weight gain(gm/day)						
< 6 hours	10.1 ± 0.97	14.27 ± 2.16	19.0 ± 2.36	23 ± 1.97	17.3 ± 3.36	0.036
6 -12 hours	11.6 ± 0.62	15.7 ± 2.68	20.5 ± 1.98	24.9 ± 1.51	18.35 ± 4.0	
>12 hours	12.4 ± 0.0	17.6 ± 2.3	21.4 ± 3.73	-	18.9 ± 3.62	
Mean	11.36 ± 0.8	15.85 ± 2.4	20.3 ± 2.7	23.95 ± 1.81	18.18 ± 3.66	

Table 3: Effect of KMC on Head circumference (HC) of neonates according hours of KMC/day

Parameter	Group A B. W. <1000 gm (n=12)	Group B B. W. 1000-1500 gm (n=237)	Group C B. W. 1500-2000 gm (n=286)	Group D B. W. 2000-2500 gm (n=36)	Study Group (n=576)	ANOVA p value
Means hours of KMC/day	6.3±3.0	6.5 ± 3.04	5.16 ± 1.73	5.02 ± 1.9	5.7 ± 2.34	
Increment in head circumference (cm/week)						
< 6 hours	0.706 ± 0.02	0.690 ± 0.052	0.636 ± 0.029	0.633 ± 0.02	0.666 ± 0.063	0.016
6 -12 hours	0.731 ± 0.05	0.701 ± 0.015	0.652 ± 0.015	0.645 ± 0.02	0.683 ± 0.043	
>12 hours	0.721 ± 0.0	0.713 ± 0.012	0.677 ± 0.02	-	0.703 ± 0.021	
Mean	0.720 ± 0.035	0.701 ± 0.026	0.655 ± 0.027	0.639 ± 0.02	0.684 ± 0.042	

Table 4: Effect of KMC on length of neonates according hours of KMC/day

Parameter	Group A B. W. <1000 gm (n=12)	Group B B. W. 1000-1500 gm (n=237)	Group C B. W. 1500-2000 gm (n=286)	Group D B. W. 2000-2500 gm (n=36)	Study Group (n=576)	ANOVA p value
Means hours of KMC/day	6.3±3.0	6.5 ± 3.04	5.16 ± 1.73	5.02 ± 1.9	5.7 ± 2.34	
Increment in length (cm/week)						
< 6 hours	1.01 ± 0.10	0.948 ± 0.074	0.928 ± 0.052	0.915 ± 0.06	0.950 ± 0.080	0.021
6 -12 hours	1.04 ± 0.10	0.950 ± 0.094	0.928 ± 0.081	0.934 ± 0.08	0.963 ± 0.089	
>12 hours	1.01 ± 0.0	0.980 ± 0.098	0.950 ± 0.048	-	0.989 ± 0.040	
Mean	1.038 ± 0.092	0.952 ± 0.079	0.935 ± 0.054	0.924 ± 0.05	0.967 ± 0.080	

Table: 5 Effect on growth of neonates According to LBW group

Group	Preterm AGA	Preterm SGA	Preterm LGA	Full Term SGA
No of Neonates (n=576)	466	45	4	61
Mean hours of KMC (hours/day)	5.9	6.2	6	4.7
Mean weight gain (gm/day)	18.4 ± 3.71	20.5 ± 5.03	18.8 ± 3.31	19.9 ± 4.53
Mean increment in Head circumference (cm/week)	0.614 ± 0.038	0.640 ± 0.042	0.619 ± 0.031	0.629 ± 0.048
Mean increment in length (cm/week)	0.903 ± 0.087	0.922 ± 0.11	0.894 ± 0.074	0.926 ± 0.094

DISCUSSION

During study period 10,622 neonates were delivered at the institute; 5.4 % were enrolled for the study, which consisted of 17.6% of LBW neonates delivered at the institute during the study period. Mean birth weight(1511 gm) of present study was comparable with Udani et al¹³(1625 gm) and Ramnathan et al¹⁴(1467 gm). 81 % neonates were Preterm AGA, followed by 10 % full term SGA, 8 % preterm SGA and 1 % preterm LGA in present study. There were no extreme preterm (<28 week) in the study. Mean Gestational age was 33.27 ± 2.62week.

Mean age of enrolment of neonates was 5.8 days as they were enrolled after once they were hemodynamically stable. 20.5% neonates were enrolled within 72 hours of birth while 2 neonates were enrolled after

14 days of life as they require prolong ventilator and CPAP therapy. Age of enrolment were comparable with Udani et al¹³(5 days), but significantly lower than Ramnathan et al¹⁴ and higher than Rao et al¹⁵(3.7 days) and Chrapak et al⁷(4 days). In 99.13 % neonates KMC was given by the mother, only 5 instances where mother had not provided KMC. With counselling and motivation 34 grandmother and 22 aunt of the neonate also started providing the KMC during the study. As per the policy of our NICU – no male relatives are allowed in the nursery; hence, none of the fathers had provided KMC to the neonate. Mean duration of hospital stay of enrolled neonate was 11.77 ± 4.8 days. Mean days of KMC during hospitalization were comparable to Udani et al¹⁵. Most of the studies had a mean duration of

hospitalization between 8 – 13 days in KMC group. Udani et al¹⁵, Ramanathan et al¹⁴, Rao et al¹⁵, Gamit et al¹⁶ & Bambharoliya et al¹⁷ were Randomized control trial (RCT) with conventional care group. As compared to other RCT; in our study mean birth weight was lower but duration of hospital stay is comparable with other studies.

Better weight gain, increment in head circumference and length noted with increased duration of KMC (p value – 0.036, 0.016 and 0.021 respectively); but significant increment in length noted in neonates receiving more than 12 hours of KMC as compared to less than 12 hours of KMC. Better gain of head circumference and length noted in VLBW and ELBW neonates. Weight gain and increment in head circumference are better in SGA [preterm (p value 0.005 and 0.01 respectively) and full term (p value 0.015 and 0.052 respectively)] neonate as compare to Preterm AGA, But no difference in increment in length noted in SGA [preterm (p value (0.17) and full term (p value 0.05)] than Preterm AGA.

Birth weight <1000 grams (ELBW): Better weight gain & increment in head circumference noted with increased duration of KMC (p 0.037, 0.04 respectively) but no effect on increment of length was noted. Mean duration of KMC was 6.3 ± 3.0 hours/day.

Birth weight 1000 – 1499 grams (VLBW): Increment in head circumference & length noted with duration of KMC more than 12 hours (p 0.037, 0.01 respectively) though weight gain also noted with lesser duration of KMC. Mean duration of KMC was 6.5 ± 3.04 hours/day.

Birth weight 1500 - 1999 grams: Increment in length noted with duration of KMC more than 12 hours (p 0.01) though weight gain and increment in head circumference also noted with lesser duration of KMC. Mean duration of KMC was 5.16 ± 1.73 hours/day.

Birth weight 2000 – 2499 grams: Better weight gain & increment in head circumference & length noted with increased duration of KMC (p 0.037, 0.04

respectively) with duration of KMC – 5.02 ± 1.9 hours/day.

Most of the studies had mean duration of hospitalization between 9 – 13 days in KMC group. Ramanathan et al¹⁴, Rao et al¹⁵, Gamit et al¹⁶ & Bambharoliya et al¹⁷ were RCT with conventional care group. In present study mean weight gain is 18.18 ± 3.66 gm/day, which is comparable to the other RCT - Bambharoliya et al¹⁷ (20.5 ± 8.84 gm/day), Chatterjee et al¹⁸ (17.64 ± 4.31 gm/day) & Socorro et al¹⁹ (18.4 ± 5.04 gm/day); which proves the efficacy of KMC on daily weight gain in the present study. Mean daily increment in head circumference (0.684cm/week) & Length (0.967 cm/week) are significantly low in present study as compare to Socorro et al¹⁹ (HC – 0.85cm/week & length 1.35 cm/week), difference may be due to variation in ethnicity, associated morbidity, inter hospital variation (staff & equipment related) which cannot be comparable.

As study was conducted at tertiary level care hospital – most of the high risk pregnancies were conducted at our institute and they were the referral patients from the far distance; which was the reason for low follow up rate. Reasons for not providing KMC at home were –busy schedule of mother, small house, lack of privacy at home. Average daily weight gain and increment in head circumference was lower in present study as compare to Rao et al¹⁵ (weight gain 23.99 gm/day, HC 0.70 cm/week and Length 0.99 cm/week) and Bambharoliya et al¹⁷ (weight gain 22.49 gm/day, HC 0.73 cm/week and Length 0.97 cm/week) but increment in length of present study was comparable to other studies.

CONCLUSION

Duration of KMC is the single most common determinant in intensifying the growth of LBW neonates; as duration of KMC is increased percentage of weight gain and increment of head circumference are also increasing, but increment in length is only seen in neonates receiving more than 12 hours of KMC. Better increment of growth parameters are observed in ELBW, VLBW & SGA neonates. KMC is

more beneficial in Small for gestational age neonates as they show better growth than Appropriate for gestational age with similar duration of KMC.

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