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Original Research Article

Impact of duration of kangaroo mother care on growth in preterm and low birth weight neonates: a prospective cohort study

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ABSTRACT

Background: Care of low-birth-weight infants is one of the most important challenges faced globally. Kangaroo mother care (KMC) is a simple and powerful, yet most cost-effective means to provide warmth, nutrition, protection from infections, caring environment and bonding, thus promoting growth. Aim was to study the impact of duration of KMC on growth in preterm low birth weight (LBW) infants.
Methods: This prospective cohort study was done in the NICU and postnatal ward in a teaching institute in Karnataka. All preterm neonates weighing 1500-2000 gm with stable hemodynamics were included in this study and allotted into two groups based on average duration of KMC per day-group I (KMC 4 hours), and group II (KMC 8 hours). All these neonates were monitored daily during their stay in the hospital and advised follow up till 6 weeks of life. The impact of KMC on growth was measured in terms of anthropometric parameters every two weeks, till 6 weeks of post-natal life.
Results: With increase in duration of KMC there was significant improvement in the anthropometric parameters (p=0.001). Those infants in group I had mean weight gain of 10.5 gm/day, length 0.80 cm/week, head circumference 0.62 cm/week, and chest circumference 0.73 cm/week. Those in group II had a mean weight gain of 15.07 gm/day, length 0.85 cm/week, head circumference 0.71 cm/week and chest circumference of 0.81 cm/week.
Conclusions: There were significant increments in anthropometric parameters when the duration of KMC per day increased. KMC can be implemented in all the healthcare centres especially in resource poor settings.

Keywords: Anthropometry, Head circumference, Length, Weight

INTRODUCTION

Low-birth-weight (LBW) infants constitute a worldwide problem with high neonatal and infant morbidity and mortality.[1] Every year around 8 million LBW infants are born in India, out of the total 20 million born globally. Prematurity and small for gestational age (SGA) together comprises over 65 percent of neonatal deaths. India when compared to other countries has the highest number of preterm deliveries and reports maximum number of deaths due to prematurity.[2]

KMC includes early and prolonged skin to skin contact with mother (or any other willing caregiver) and exclusive breast feeding. It is a cost effective and simple method of care for LBW infants. KMC is a natural form of human care which does not require any sophisticated equipment and has many advantages such as stabilizing the body temperature, promoting breast feeding, prevention of infections and other morbidities. It also helps in early discharge, better growth and neurodevelopment while encouraging bonding between mother and infant.[3] It is always better to initiate KMC in

the hospital itself and to be continued at home until infants need it. For optimum care, regular follow up must be ensured.

KMC is a evidence based, high impact intervention and standardized care for LBW infants which can be a part of routine care with no additional resource requirement as breast feeding. It can prevent around 50 percent of all neonatal deaths among <2000 gm babies.[4] The 2011 updated Cochrane review revealed that KMC resulted in improved weight, length and head circumference and increased breast-feeding rates.[3] Providing KMC reduced the incidence of severe illness including pneumonia and sepsis and other nosocomial infections during infancy. In most of the studies, KMC has been found to be more effective than incubator care for stable newborns in providing adequate thermal care, improving exclusive breastfeeding and weight gain, and fostering greater maternal and family involvement in neonatal care-all at a lower cost than incubator care.[3]

However, implementation of KMC has been low despite its known benefits. Even at places where it is being practiced, the duration of KMC is still low averaging to 3-5 hours per day as in previous Indian studies.[5] Potential barriers are lack of adequate support for mothers, absence of formal counseling on KMC by the healthcare team, and other maternal factors including lack of privacy, stress and fatigue.[3] There are many studies.[7,8] Which showed improved clinical status and outcome in preterms when provided with adequate KMC, some studies have even proved the benefits of increasing duration of KMC. In some of those studies there was a significant improvement in growth parameters especially weight gain when given more hours of KMC.[7-11]

But studies on KMC in India are limited. The present research aimed to study the impact of duration of KMC on growth including weight, length, head circumference, and chest circumference in preterm LBW babies.

METHODS

This observational cohort study was done in the neonatal intensive care unit (NICU) and postnatal wards in Cheluvamba hospital (MMCRI), Mysore, from November 2020 to June 2021.

Ethical considerations were taken into account and each parent was informed about the purpose of study and they had the freedom to leave this study anytime at their will without assigning any reason. Approval from the Institutional ethics committee, MMCR and I (ECR/134/Inst/KA/2013/RR-16) was taken before the initiation of this study.

Sample size estimation

$Z^2\,pq/d^2$

Where Z=1.96, p=prevalence of preterm babies, d=95% confidence interval and q=(1-p), with prevalence of preterm being 25% (total number of admissions to NICU averages to 200 and preterm births around 40-45 per month) in the study hospital, a sample size of 100 was obtained ($1.96\times1.96\times25\times0.75/d^2$).

Inclusion criteria

All the eligible preterm (LBW) and term (LBW) (between 1500-2000 gm), with stable hemodynamic status were included in the study.

Exclusion criteria

Neonates with detectable gross congenital anomalies, chromosomal abnormalities, those with evidence of respiratory distress, requiring any resuscitative measures at birth and on positive pressure or mechanical ventilator, post term babies were excluded.

Gestational age of the infant was determined by performing modified Ballard scoring.[6] The demographic details including age, sex, birth weight, gestational age, APGRAR score, maternal and paternal age, education, occupation, and socioeconomic status were documented in the predesigned pro forma. All mothers and their family members were encouraged to keep their babies in KMC for as long as possible and provide exclusive breastfeeding. KMC was initiated in all eligible babies in our neonatal intensive care unit and postnatal/KMC ward. Advantages of KMC and benefits of increasing duration of KMC were explained to each parent. Mothers were educated regarding hygiene measures (hand washing, short and clean fingernails), daily baths, and clean clothes. All mothers were trained for providing KMC and were given KMC chart to maintain a record of duration of KMC hours.

For the purpose of analysis the cohort was divided into two groups (random allocation by nursing staff and was advised same feeding protocol-on exclusive breast feeding, with multivitamins, calcium, iron supplements added and HMF sachets once the babies reach full feeds) based on the duration of KMC hours per day, as follows: Group I: 4 hours, and group II: 8 hours. They were monitored daily during their stay in the hospital and after discharge from hospital; mothers were advised to follow up weekly till 6 weeks of life.

The infants were assessed for well-being, feeding and growth was measured in terms of weight (same electronic weighing machine), length, head circumference and chest circumference with the same non-stretchable measuring tape in every visit till 6 weeks of postnatal life by the neonatologist who was unaware of duration of KMC. Various barriers faced by mothers as well as staff members for providing KMC were addressed by proper counseling and providing a safe and comfortable environment.

Statistical analysis

Data was recorded on predesigned pro forma which was entered in MS excel sheet. Subsequently the data was analyzed using SSPS version 21.0 statistical software, with tests of significance like chi-square test applied accordingly.

RESULTS

Total of 100 babies were included in this study, out of which 55 % were male and 45% were female babies. The gestational age was between 30-37 weeks. In this study, 50 out of 100 babies given 4 hours of KMC and remaining 50 babies received 8 hours of the KMC. The babies in both groups were like each other demographically (Table 1).

The babies in group I (KMC for 4 hours) had mean weight gain of 10.52 gm/day, and those in group II (KMC for 8 hours) had a mean weight gain of 15.09 gm/day. There was a significantly higher weight gain per week in babies with longer KMC duration. (Group II). There was no significant increase in length during 6 weeks follow up (p=0.21). Head circumference and chest circumference (p=0.001) also showed significant increase in babies who received longer duration of KMC (Group II) (Table 2 and 3).

The babies between 33-34 weeks had a higher weight gain compared to 30-32 weeks and 35-37 weeks group. The weight gain is higher among 33-34 weeks group but is not statistically significant. Also, appropriate for gestational age babies showed a higher weight gain/day compared to small for gestational age babies.

Other anthropometric parameters (length, head circumference and chest circumference) were comparable among different gestational age groups, birth weight category, and AGA/SGA groups (Table 3 and 4).

Table 1: demographic data.

Variables	Group I (4 hours)	group II (8 hours)	P value
Gender			
Male	32	23	0.07
Female	18	27	
Appropriateness for gestational age			
Appropriate for gestational age	27	28	0.420
Small for gestational age	23	22	
Gestational age (Weeks)			
30-32	20	19	0.611
33-34	12	10	
35-37	18	21	
Mean (SD)	2		
Birth weight (kg)			
1-1.5	17	16	0.60
1.5-1.75	24	26	
1.75-2	9	8	
Mean	1.6	1.68	0.76
Parent education (mother)			
Illiterate	9	4	0.10
1-4 class	5	2	
5-7	7	3	
8-10	16	14	
PU	12	17	
Degree	0	10	
Professional	1	0	
Socioeconomic status			
Class 3	1	7	0.06
Class 4	19	27	
Class 5	30	16	

Table 2: Increments in growth parameters during 6 weeks follow up of study population.

Growth parameters	Groups (Duration of KMC)	1st 2 weeks	2-4 weeks	4-6 weeks
Weight (gm)	Group I	130.2	138.0	106.2
	Group II	226.1	202.5	205.5
Length (cm)	Group I	2.08	1.56	1.20
	Group II	2.16	1.61	1.34
Head circumference (cm)	Group I	1.39	1.32	1.08
	Group II	1.64	1.43	1.23
Chest circumference (cm)	Group I	2.01	1.22	1.16
	Group II	2.45	1.40	1.42

Table 3: Overall gain in all anthropometric parameters based on duration of KMC.

KMC	Weight/day-gm	Length/week-cm	HC/week-cm	CC/week-cm
Group I	10.5	0.78	0.62	0.73
Group II	15.07	0.83	0.71	0.81
P value	0.001	0.59	0.001	0.001

Table 4: Growth increments in different gestational age groups based on KMC duration.

Groups	AGA	SGA	30-32 weeks	33-34 weeks	35-37 weeks
Weight gain in grams per day					
Group I	10.02	9.82	11.92	12.22	10.76
Group II	13.52	14.05	15.14	13.99	13.87
P value	0.02	0.001	0.001	0.56	0.02
Length increments (cm)					
Group I	4.84	4.32	4.76	4.86	4.82
Group II	5.10	4.98	5.01	5.00	5.12
P value	0.82	0.90	0.90	0.96	0.88
Head circumference increments (cm)					
Group I	3.72	3.78	3.82	3.88	3.72
Group II	4.32	4.31	4.65	4.95	4.54
P value	0.05	0.02	0.001	0.001	0.001
Chest circumference increments (cm)					
Group I	4.44	4.43	4.53	4.42	4.46
Group II	5.20	5.14	5.27	5.22	5.24
P value	0.001	0.001	0.001	0.001	0.001

DISCUSSION

World health organization (WHO) defined LBW as weight at birth less than 2,500 grams which can be a consequence of preterm birth or due to small size for gestational age or both. KMC is associated with reduced incidence of severe illness and also reduces morbidity and mortality during infancy by ensuring temperature maintenance, providing nutrition through breast milk, facilitating physiological stability. It also helps in post natal growth rate, simulating intrauterine growth.[1]With increased duration of KMC there has been an increase in growth parameters, especially weight gain in preterm babies, there was a shorter duration of hospital stay, an earlier attainment of full feeds and overall better outcome.[2]

In a prospective study by Mekala et al where babies were given KMC for a duration of 4, 8 and 12 hours, showed a higher weight gain in 12 hours group (17 gm/day) as compared to 9.93 and 14.7 gm/day in 4 and 8 hrs group, respectively.[7] A similar cohort research studied inborn babies weighing <2000 gm at birth who were divided into four groups 1 (KMC <6 hours), 2 (KMC 6-12 h), 3 (12-20 h) and 4 (>20 h). It concluded that with an increase in the duration of hours of KMC the anthropometric parameters had been improved and duration of hospital stay reduced.[8]

The mean weight gain in our study showed a significant increase with increasing duration of KMC. The overall weight gain was lower than what obtained in a study by Mekala et al, Rao et al and Ramnathan et al and it could be because of short duration of follow up in this study.[7,9,10] Duration of KMC and difference in weight gain was comparable in both 4 and 8 hours group (present study v/s Mekala et al-4 h-10.52, 8 h-15.07 v/s 9.93, 14.7) which showed improved values with increase in duration of KMC.[7] Weight gain in the 30-32 gestational group was higher when given longer hours of KMC than 33-37 group comparable with that of Mekala et al.[7] This was lower compared to study done by Udani et al.[8] In less than 1500 gm birth weight group the weight gain was much lower compared to Udani et al (10.78 in present study v/s 17.42 gm/d in Udani) but here again we can see an increase with longer duration of KMC.[8] The weight gain was much higher in the study done by Hann et al (27.7 gm/d) as they provided aggressive nutrient supplementation.[11]

Since the increase in length is slower it was less reliable and did not show any significant difference with increasing duration of KMC. The increments in length/week were 0.78 cm/week in 4 hours and 0.83 cm/week in 8 hours which was higher than 0.65 cm/week obtained in the study by Udani et al and was lower than that attained through nutritional support by Ehrenkranz (0.9 cm/week).[8,12] Among SGA babies we noted an increase of 0.83 cm/wk (AGA-0.80 cm/w) which was higher than that obtained in Udani (0.74 cm/wk).[8] In the present study there was no significant change with duration of KMC in length.

The measurement of increments in head circumference was 0.72 cm/week was less than 0.63 cm/week obtained in the study by Udani et al and was comparable with Rao et al (0.75 cm/week).[8,9] This was lower than the WHO recommendation (0.75 cm/week).[13] There was a progressive increase in HC and it was higher in 8 hours group (0.78 cm/week) than 0.66 cm/week in 4 hours group. In sub group less than 1500 gm birth weight group this more (0.70 cm/week) than 0.58 cmm/week in Udani et al and comparable to Rao et al (0.75 cm/week).[8,9] Rao et al in their study had a weekly increment of 0.74 cm/week in SGA babies (present study-0.66 cm/week).[9]

The overall gain in chest circumference was comparable to a study conducted by Udani et al (0.80 cm/week).[8]

There was a significant increase in chest circumference as duration of KMC increased (Group 1:4 hours-0.73 cm/week and group 2:8 hours-0.81 cm/week). In the sub group of less than 32 weeks gestational age, we found 0.8cm/week(4.53cm) and less than 1500g had an increment of 0.78 cm/week (4.43) which was higher than Udani et al (0.67 and 0.65cm/week). However, the increments in chest circumference in SGA group in Udani was 0.95 cm/week v/s 0.79 cm/week in the present study.[8]

It can be said that a longer duration of KMC provided per day is likely to have better neonatal outcomes. Kangaroo position should be maintained as long as possible, however shorter KMC also have beneficial effects on breast feeding, morbidity and mortality.

Limitations

The study was confined only to babies with gestational age between 30-37 weeks and included only babies with birth weight of 1500 to 2000 gm. Other physiological parameters of the neonate such as heart rate, respiratory rate, RBS, bilirubin, electrolytes were not monitored.

CONCLUSION

This study concludes that the anthropometric parameters improve better when the duration of KMC is increased. Great results are obtained with weight, there was higher gain in weight in all the sub groups with increased duration of KMC. Chest circumference and head circumference showed similar trend but not to a drastic extend as in weight. Length did not show any significant difference after increasing duration of KMC, which require longer follow up to get exact impact of KMC on length. Thus, proper advice regarding continuation of KMC at home, and regular follow up may yield a better outcome.

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