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Original Research Article

The effect of kangaroo mother care on stabilization of vital signs heart rate, respiratory rate and arterial saturation in low-birth-weight preterm babies

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ABSTRACT

Background: Kangaroo mother care (KMC) have positive effects on the preterm infant's health status in the form of stabilization of vital parameters. Therefore, this study was conducted to evaluate the effect of KMC on stabilization of vital signs in low-birth-weight premature babies.
Methods: This is a quasi-experimental study. One hundred and seventy newborns who were admitted to in neonatal intensive care unit of Karnataka institute of medical sciences Hubli, India were selected by convenience sampling. They were randomly divided into experimental group, n=85 and control group, n=85. In the experimental group, newborns were taken daily KMC for four hours during 7 days. In the control group, routine care was performed. The data gathering tool was questionnaire of infants and mother characteristics, checklists of vital signs using SPSS 22 version software. Chi-square test was used as test of significance for qualitative data. Continuous data was represented as mean and SD. P<0.05 was considered as statistically significant.
Results: Before intervention, there was no significant difference between the vital signs of the infants in experimental and control groups. However, after intervention, there was a significant difference between the two groups in terms of vital parameters (p<0.001).
Conclusions: The findings of this study indicate the effect of KMC on stabilization of vital signs, it is recommended that KMC is taken as one of the routine cares of premature low birth weight babies.

Keywords: KMC, Premature infant, Low birth weight

INTRODUCTION

The 7.5 million low birth weight babies are born in India every year, accounts for maximum number of neonatal deaths due to prematurity. Incidence of LBW in India is about 30% of total live births. Neonates born before 37 completed weeks of pregnancy are called premature infants. Premature infants are more prone to several problems, such as respiratory distress syndrome, infections, apnea of prematurity, intra ventricular hemorrhage and others.[1] Therefore, care for such infants is a burden on community health systems. Most common method for care of premature infants is incubator method. In this way, the infant undergoes a special care in a glass device which is costly and required skilled workers and experts which is economic burden on the family and on the society. Meanwhile, in alternative method as known as KMC, KMC is a low resource, cost effective, evidence based, high impact intervention and standardized care for LBW infants, it can prevent up to half of all deaths in infants weighing <2000 gm.

KMC is a simple method of care for LBW infants that includes early and prolonged skin to skin contact with the care giver and exclusive breast feeding, this natural form of human care stabilizes body temperature, promote breast feeding and other morbidities. This also leads to early discharge, better neurodevelopment.[3]

The baby is placed between the mother's breasts in an upright position. Mother secures him with the KMC sling. The baby's head, turned to one side, is in a slightly extended position. This position keeps the airway open and allows eye-to-eye contact between the mother and the baby. The hips should be flexed and extended in a "frog" position; the arms should also be flexed. Baby's abdomen should not be constricted and should be somewhere at the level of the mother's epigastrium. This way baby has enough room for abdominal breathing. Mother's breathing stimulates the baby.[4] KMC first started in Columbia in 1978, and in India it was first introduced in 1994 in BJ medical college hospital, Ahmedabad.

The high prevalence of premature infants, the lack of specialized care equipment and the high mortality rate of premature infants are among the reasons for the use of KMC for premature infants.[5] Various studies have shown that KMC has had favorable results for neonates and mothers, which includes: favorable effects on heartrate, oxygen saturation and respiratory rate[6], maintaining body temperature and sleeping of the infant, helping to increase mother's emotional feelings toward newborn.[7-9]

Objective of the study: To know the effect of KMC on stabilization of vital parameters viz heart rate, respiratory rate and arterial oxygen saturation in preterm low birth weight babies

There is no funding, no conflict of interest, Institute ethical clearance has been taken for this study

METHODS

This is a quasi-experimental study in premature neonates admitted to the neonatal intensive care unit (NICU) of Karnataka institute of medical sciences Hubli, India. The study was conducted from January 2020 to October 2020. Sample size was estimated according to the preliminary study and the following formula with considering 95% confidence level, power of 90% and 10% of sample drop. In the formula: Z is standard normal deviation set at 95% level; μ is assumed population mean and σ is the estimated standard deviation. The study included 170 preterm babies with birth weight of less than or equal to 1800 gm, and randomly divided into cases (n=85) and controls (n=85).

Inclusion criteria

Infant weight at birth less than or equal to 1800 gm, neonatal birth age of <36 weeks of gestation, neonates stable enough to leave the incubator and be with the mother, baby on breast feeding and the newborn has not undergone any surgery.

Exclusion criteria

Neonates too sick to participate in the study, neonates on mechanical ventilation, maternal illness or complications preventing her from caring her baby, decline parental consent before or during the study, babies with obvious major congenital anomaly.

The newborns who met the inclusion criteria were selected by convenience sampling to complete the sample size. Before the beginning of the study, informed consent was obtained from the infant's parents. Then, the infants were randomly divided into experimental and control groups. The two experimental and control groups were homogeneous in terms of infant's weight and gestational age. Before intervention, demographic data were collected by a questionnaire and neonates of both groups were evaluated for, oxygen saturation, heart rate, respiratory rate. The questionnaire consisted of characteristics of the mother and her neonate including maternal complications during pregnancy and breast-feeding status. Vital parameters (heart rate, respiratory rate, oxygen saturation), are measured and recorded before and on the first, third, fifth and seventh days of KMC. In the experimental group, first, mother or care giver took bath, wearing a special KMC sling, and perform KMC. With the help of nursing staff, neonate was placed between mothers' breasts. KMC care conducted for four hours per day for seven days. Room temperature was 26-29°C and humidity of 60%. In the control group, conventional care (incubator) was performed. For both groups, the vital parameters of the infant were measured 3 times in each KMC practice (before, two hours after initiation KMC (median) and after completed KMC i.e., at the end of 4th hours of KMC). At the end, changes in vital signs of premature infants were compared in both groups.

Statistical analysis

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of frequencies and proportions. Chi-square test was used as test of significance for qualitative data.

Continuous data was represented as mean and SD. Independent t test was used as test of significance to identify the mean difference between two quantitative variables.

Graphical representation of data

MS excel and MS word were used to obtain various types of graphs such as bar diagram, and line diagram.

P value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Statistical software

MS excel**,** SPSS version 22 **(**IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

RESULTS

Demographic characteristics of subjects age of the mother, mother employment, father employment are presented in Table 1-3 respectively. Based on the results of the study, the data were homogeneous in terms of mothers' age, and parents' employment status (p>0.05).

Table 1: Age of the mother distribution comparison between two groups.

Variables		Groups			
		Cases		Controls	
		Count	%	Count	%
Age (Years)	<20	8	9.4	5	5.9
	21 to 30	62	72.9	64	75.3
	>30	15	17.6	16	18.8
	Mean ± SD	25.80±4.364		26±4.657	

X^2=0.756, df=2, p=0.685.

Among cases majority of them were in the age group 21 to 30 years (72.9%) and among controls majority of them were in age group 21-30 years. There was no significant difference in age distribution between 2 groups.

Table 2: Mother employment distribution comparison between two groups.

Variables		Group			
		Cases		Controls	
		Count	%	Count	%
Mother employment	Yes	6	7.1	5	5.9
	No	79	92.9	80	94.1

X^2=0.097, df=1, p=0.755.

Among cases, 7.1% of mothers were employed and among controls, 5.9% of mothers were employed. There was no significant difference in mother employment between two groups.

Table 3: Father employment distribution comparison between two groups.

Father employment	Group			
	Cases		Controls	
	Count	%	Count	%
Employed	81	95.3	83	97.6
Unemployed	4	4.7	2	2.4

X^2=0.691, df=1, p=0.406.

Among cases, 95.3% of fathers were employed and 4.7% were unemployed and among controls, 97.6% of fathers were employed and 2.4% were unemployed. There was no significant difference in father employment between 2 groups.

There was no significant difference in the rate of infants' heart rate in two groups before intervention (p>0.05). After KMC, significant change were observed in heart rate of experimental group while no significant change was seen in the control group (Table 4).

Independent samples test

In the study there was significant difference in mean heart rate between two groups before KMC, mid 2 hours after KMC and after 4 hours KMC on day 1, day 3, day 5 and day 7.

At these intervals mean HR was high in cases on day 1, mean HR was low in cases on day 3, day 5 and day 7.

The respiratory rate of infants in the experimental and control groups was not significantly different before intervention (p>0.05). Significant change was observed in respiratory rate of experimental group after KMC intervention, while no significant change was seen in the control group.

In the study there was significant difference in mean respiratory rate between two groups before KMC, mid 2 hours after KMC and after 4 hrs KMC on day 1, day 3, day 5 and day 7.

At these intervals mean respiratory rate was low in cases on day 1, day 3, day 5 and day 7.

Before KMC, intervention, the percentage of arterial blood oxygen saturation in the experimental and control groups was not different (p>0.05). After KMC, significant change was observed in arterial blood oxygen saturation of experimental group after KMC, while no significant change was seen in the control group.

In study there was significant difference in mean SpO_2 between two groups at mid-2 hours and after 4 hours of KMC on day 1, day 3, day 5 and day 7. At these intervals mean SpO_2 was high in cases compared to controls.

There was no significant difference in SpO_2 between two groups before KMC.

Table 4: Heart rate comparison between two groups at different periods of follow-up.

Variables		Groups				T value	P value
		Cases		Controls			
		Mean	SD	Mean	SD		
Day 1	Before KMC	168.65	2.25	167.45	2.23	3.489	0.001
	Mid 2 hrs after KMC	154.99	2.12	167.21	2.04	-38.302	<0.001
	After 4 hrs KMC	146.41	2.44	167.09	2.35	-56.234	<0.001

Continued.

Variables		Groups				T value	P value
		Cases		Controls			
		Mean	SD	Mean	SD		
Day 3	Before KMC	162.62	2.12	166.98	2.24	-13.038	<0.001
	Mid 2 hrs after KMC	152.81	2.36	167.19	2.14	-41.619	<0.001
	After 4 hrs KMC	143.81	2.68	167.05	1.81	-66.154	<0.001
Day 5	Before KMC	161.07	1.93	167.08	1.94	-20.271	<0.001
	Mid 2 hrs after KMC	153.62	1.95	166.81	2.33	-40.031	<0.001
	After 4 hrs KMC	143.96	2.32	167.01	2.65	-60.333	<0.001
Day 7	Before KMC	159.16	1.40	166.88	2.01	-29.033	<0.001
	Mid 2 hrs after KMC	153.04	2.38	167.13	2.12	-40.742	<0.001
	After 4 hrs KMC	145.87	2.64	166.76	2.09	-57.195	<0.001

Table 5: Respiratory rate comparison between two groups at different periods of follow-up.

Variables		Group				T value	P value
		Cases		Controls			
		Mean	SD	Mean	SD		
Day 1	Before KMC	63.62	1.22	64.33	2.05	-2.726	0.007
	Mid 2 hrs after KMC	55.58	1.66	65.68	2.06	-35.180	<0.001
	After 4 hrs KMC	53.35	1.42	65.59	2.26	-42.207	<0.001
Day 3	Before KMC	61.47	1.25	66.34	1.99	-19.142	<0.001
	Mid 2 hrs after KMC	55.52	1.31	66.33	2.20	-39.026	<0.001
	After 4 hrs KMC	53.29	1.41	65.92	2.49	-40.605	<0.001
Day 5	Before KMC	59.89	1.08	66.84	1.91	-29.118	<0.001
	Mid 2 hrs after KMC	54.75	1.90	66.59	2.09	-38.567	<0.001
	After 4 hrs KMC	52.40	1.42	66.84	1.79	-58.410	<0.001
Day 7	Before KMC	60.79	1.62	66.84	1.77	-23.229	<0.001
	Mid 2 hrs after KMC	53.62	1.77	66.82	1.76	-48.805	<0.001
	After 4 hrs KMC	52.76	1.59	66.82	1.73	-55.170	<0.001

Table 6: SpO_2 comparison between two groups at different periods of follow-up.

Variables		Group				T value	P value
		Cases		Controls			
		Mean	SD	Mean	SD		
Day 1	Before KMC	87.52	1.14	87.42	1.34	0.493	0.622
	Mid 2 hrs after KMC	93.41	1.48	87.45	1.38	27.111	<0.001
	After 4 hrs KMC	95.87	1.10	87.41	1.28	46.122	<0.001
Day 3	Before KMC	87.59	1.22	87.73	1.30	-0.730	0.467
	Mid 2 hrs after KMC	94.66	1.17	87.82	1.30	35.996	<0.001
	After 4 hrs KMC	95.93	1.16	87.82	1.36	41.845	<0.001
Day 5	Before KMC	87.78	1.28	87.76	1.26	0.060	0.952
	Mid 2 hrs after KMC	93.36	1.53	87.73	1.15	27.200	<0.001
	After 4 hrs KMC	95.21	1.65	87.56	1.48	31.793	<0.001
Day 7	Before KMC	87.84	1.36	87.85	1.44	-0.055	0.956
	Mid 2 hrs after KMC	93.78	1.57	87.55	1.25	28.614	<0.001
	After 4 hrs KMC	95.81	1.63	87.49	1.27	37.133	<0.001

DISCUSSION

According to results after KMC, significant differences in vital parameters were observed between the experimental and control groups. In the study of Nourian et al who compared the effect of KMC and routine care methods on physiological criteria in low-birth-weight infants, no significant differences observed between 2 groups during intervention ($p>0.05$). However, significant differences were seen between two groups in terms of heart rate, oxygen saturation and respiratory rate 5 minutes after intervention ($p<0.05$). The results showed that KMC care is effective on sustainability of physiological parameters during care. Therefore, caregivers should take KMC for their newborn baby.[10] In a study by Basiri et al the effect of duration of KMC on neonatal growth of low-birth-weight infants studied. One hundred-fifteen LBW neonates randomly divided into 2 groups, first group

received the maximum of 4 hours KMC per a day and the second group got more than 4 hours KMC per day. In the kangaroo care more than 4 hours, the mean and standard deviation of oxygen saturation was higher than a group with less than 4 hours Kangaroo care (p>0.05). Infants' growth and physiological criteria were better in group with more than 4 hours KMC compared to less than 4 hours KMC.[11] Therefore, it is essential that the strategies of increasing the duration of kangaroo care be taken into consideration by policy makers and healthcare providers. It is suggested that, the positive effects of kangaroo care and the safety of this method taking into account and KMC is used more widely. In the study of McCain showed that heart rate variability, especially the parasympathetic component, was high when the infant was fussy in open crib, indicating increased autonomic nervous system activity. With kangaroo care, infant fell asleep, and both sympathetic and parasympathetic components of heart rate variability decreased.[12]

KMC improves physiological indices in normal levels; thus, it might positively influence premature infant's physical health. Further study is needed to determine long-term outcomes of KMC in low birth weight and premature infants. In study of Parsa et al showed that Before intervention, there was no significant difference between physiological parameters of infants (heart rate, respiratory rate, arterial blood oxygen saturation and temperature) in experimental and control groups.[13] However, after intervention, there significant difference in 2 groups in terms of physiological indices (p<0.001).

Limitation of the study was small sample size.

CONCLUSION

The findings of this study clearly show the effect of KMC on stabilization of heart rate, respiratory rate and arterial oxygen saturation. This suggests the need to improve the knowledge of the parents and caregivers of preterm, low birth weight babies on KMC. Therefore, health workers must understand about all aspects of KMC.

Recommendations

Since KMC is cost effective care for stabilization of vital parameters in preterm low-birth weight babies, policy makers should establish KMC center in every secondary and tertiary care centers of health sector.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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