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Effects of Kangaroo Mother Care on the Physiological, Behavioral, and Psychosocial Outcomes of Preterm Infants in Various Hospitals in Karnataka

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Abstract

Background: *Kangaroo mother care (KMC) is a technique that encourages skin-to-skin contact, offering various physiological, behavioral, and psychosocial benefits for preterm infants. The objective is to assess the impact of KMC on the physiological, behavioral, and psychosocial development of premature babies.* ***Study Design:*** *This was a quasi-experimental research investigation.* ***Materials and Methods:*** *A purposive sample of sixty premature infants and their mothers was drawn from neonatal intensive care units (NICUs) according to specific inclusion and exclusion criteria. They were divided into two equal groups: the first group (30) received KMC, while the second group (30) received conventional care. Data was collected using the KMC Assessment Flow Sheet (KMCAFS) and the Mother Bonding Behavioral Scale, with assessments conducted both before and after the intervention. The research was accessible three days a week, five hours each day. The average number of cases collected per week ranged between 3 and 4 preterm newborns and their mothers.* ***Results:*** *The results indicated that there were statistically significant differences in the physiological outcomes of premature infants before and after the application of KMC. In the pre-test, the average score for physiological outcomes was 6.3, with a standard deviation of 2.62. In contrast, the post-test revealed an average pain level of 3.83 and a standard deviation of 1.89. The paired 't'-test value obtained 36.29 was significant, and P-value ≤0.05) for heart rate, respiration rate, temperature, and weight increase, respectively.* ***Conclusion:*** *KMC effectively and significantly promoted physiological stability, behavioral organization, and improved psychosocial outcomes of preterm infants compared to those receiving standard care.*

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Keywords: Kangaroo mother care (KMC), neonatal intensive care units (NICUs), preterm infants, psychosocial outcomes, behavioral scale

INTRODUCTION

Preterm delivery occurs more than three weeks before the neonate's due date. In other words, it occurs after a gestation period of less than 37 weeks, typically around 40 weeks [1]. The global burden of newborn deaths is expected to approach five million each year. Only 2% (0.1 million) of these deaths occurred in wealthier countries, whereas the remaining 98% (4.9 million) occurred in developing countries. South Asian countries have the highest neonatal mortality rates, with over two million newborn deaths in the region each year, with India accounting for 60%. Preterm birth is the leading cause of neonatal mortality. Additionally, preterm

birth and small for gestational age (SGA) are important indirect factors associated with low birth weight (LBW), which significantly contributes to neonatal death. LBW is responsible for 60%–80% of all infant mortalities. Globally, the prevalence of LBW is 15.5%, leading to approximately 20 million LBW infants born annually, with 96.5% of these births occurring in developing countries [2]. It is estimated that preterm birth is the direct cause of 28% of newborn fatalities, worldwide. Mothers with premature babies experience a range of stressors and negative emotions including anxiety, guilt, helplessness, and despair. The highly technological surroundings, as well as the preterm infant's look and behavior, frequently cause disruptions in assuming the maternal role and a worse quality of mother-infant bonding. These early abnormalities may contribute to long-term difficulties for mothers and put preterm newborns at risk for further cognitive, emotional, behavioral, and developmental impairments. kangaroo mother care (KMC) pertains to the care provided for premature infants weighing less than 2 kg. This includes exclusive and consistent breastfeeding, skin-to-skin contact, and care for the mother-infant pair, which has been shown in hospital-based studies in low- and middle-income countries to lower mortality rates [3–6]. Thus, Kangaroo Care ensures that people from all economic backgrounds can provide necessary care for premature newborns. Preterm newborns' temperatures rise slowly, preventing hypothermia. Consequently, premature babies become quiet and peaceful. It also aids the baby in conserving energy and restoring organ functions.

NEED FOR THE STUDY

Every year, approximately 15 million infants are born prematurely worldwide, representing over 10% of all births. More than a million infants die shortly after birth, and many others experience lifelong physical, neurological, or educational disabilities, which often lead to significant costs for families and society. Recent surveys have indicated that India has the highest number of preterm birth-related deaths globally, with nearly half of all child mortalities attributed to preterm births. Studies have indicated that skin-to-skin interactions with mothers promote neurobehavioral development in preterm infants. In developing countries, such as India, the reliance on incubators for managing LBW newborns imposes a considerable financial burden on parents. Due to the exorbitant expenses of incubators, family members of low-birthweight babies cannot afford them. As a result, equally effective and low-cost techniques for managing low-birthweight newborns, such as KMC, must be made known to mothers of low-birthweight babies. KMC not only helps reduce hypothermia in LBW infants but also enhances the bond between the mother and baby. Nurses, who frequently interact with parents, play a crucial role in educating mothers of LBW infants about KMC. A randomized controlled trial was conducted to evaluate the impact of KMC on breastfeeding rates, weight gain, and length of hospitalization for very LBW neonates, as well as to assess its acceptability among nurses and mothers. The study involved infants weighing less than 1500 g at birth, provided that they were stable. Results showed that neonates in the KMC group experienced greater weight gain after the first week of life (15.9 ± 4.5 gm/day in the KMC group compared to 10.6 ± 4.5 gm/day in the control group) and were discharged earlier from the hospital (27.2 ± 7 days for the KMC group versus 34.6 ± 7 days for the control group). Thus, KMC contributes to better weight gain and earlier hospital discharge, making it an excellent complement to the care of LBW infants. During clinical experience, the investigator noted that many LBWs and preterm infants die during the neonatal period due to complications associated with their conditions, and most mothers of these infants are unaware of the benefits of KMC [7–10]. As a result, the investigator believed that by teaching the mothers of these newborns, the death rates of low birth weight and preterm births may be reduced. The number of babies has decreased dramatically decreased. This prompted the investigators to conduct the study.

Objectives

1. To assess the effectiveness of physiological, behavioral, and psychosocial outcomes of the experimental and control groups.
2. To assess the effectiveness of KMC by utilizing the KMC Assessment Flow Sheet (KMCAFS) in both the experimental and control groups.
3. To determine the association between mothers 'characteristics and preterm babies' attachment to the experimental group.

4. To determine the association between mothers' characteristics and satisfaction in the experimental group.

MATERIAL AND METHODS

Research Approach

An experimental research approach was used to determine the effectiveness of kangaroo maternal care on the physiological, behavioral, and psychosocial outcomes of preterm babies.

Research Design

The study design was a quasi-experimental study.

Variables Under Study

In this study, the independent variable was KMC, and the dependent variables were physiological, behavioral, and psychosocial outcomes among preterm babies. Demographic variables included the age of the mother, education, occupation, parity, mode of delivery, sex, birth weight, gestational age, chronological age, and APGAR score.

Research Setting

The present study is conducted in selected hospitals, in Karnataka and Kerala.

Sample and Sampling Technique

Sample: The study sample consisted of 60 stable preterm babies

Sampling Technique

A purposive sample of 50 premature infants and their mothers was selected from the previously mentioned setting and divided into two equal groups: the first group (30) received KMC, and the second group (30) received conventional care (standard incubator care provided by hospital staff nurses). Participants were selected based on specific inclusion and exclusion criteria.

Inclusive Criteria

All Stable premature infants both gender

Exclusive Criteria

High-risk premature infants may have infections, severe respiratory distress, require ventilation or oxygen therapy, or have congenital abnormalities.

Data Collection Tools

Data was collected through the following tools:

1. *KMC Assessment Flow Sheet:* This encompasses demographic details regarding preterm infants and their mothers in both experimental and control groups. These data were used to assess the impact of KMC on the physiological, behavioral, and psychosocial outcomes of preterm infants. The researcher implemented the necessary modifications to meet the specific needs of the current study. The following aspects were addressed in [11].
    a. The characteristics of premature infants were assessed based on sex, gestational age, birth weight, length of hospital stay, and APGAR scores. This information was obtained from infants' medical records during their time in the hospital.
    b. *Characteristics of mothers.* This includes information such as age, educational level, employment status, number of pregnancies, and delivery methods.
    c. *Effect of KMC on premature infants' physiological, behavioral, and psychosocial outcomes;* The physiological outcomes consist of the heart rate, respiratory rate, body temperature, and weight gain of preterm infants.

- Premature infants cry, sleep, feed type, and respond to sound *(behavioral outcomes).*
- Mother-infants' attachment *(psychosocial outcomes).*

d. Mother's satisfaction and mother's perception regarding KMC.

Data Collection Process

Consent was obtained from all participants to participate in the study was obtained from all participants. Baseline Characteristics were collected using the demographic proforma. KMCAFS was used to assess preterm infants' physiological, behavioral, and psychosocial outcomes. On the same day, KMC was provided to the preterm babies in the experimental group for one hour. Each preterm infant was evaluated before and after receiving KMC to assess physiological, behavioral, and psychosocial outcomes as well as the mothers' views on KMC. After ten days a post-test will be conducted using the same KMCAFS in the same group of preterm babies.

Data analysis: The gathered data were arranged, examined, formatted into tables, and analyzed using the SPSS software. Descriptive statistics were used to calculate the percentages and frequencies of the experimental and control groups. Suitable statistical tests, such as the chi-square test, were used to assess statistically significant differences between groups.

2. *Pre/post mother's bonding behavioral scale:* The study aimed to assess mothers' emotional, psychological, attachment, and behavioral interactions with their premature newborns during breastfeeding. Researchers observed both the mother and infant, utilizing six statements to gauge responses. Mothers' responses were classified into two categories: positive and negative.

Validity and Reliability

The researchers consulted textbooks, journal articles, and scientific publications to review relevant regional and international literature on the study topics. This helped the researchers understand the research topic and advised them in preparing and constructing the study materials. To ensure the content validity of the study tools, the researchers presented items to experts for review and validation to ensure that they accurately represented the intended measurement.

The goal is to assess the stability of answers from the same premature newborn and mother, often known as test-retest reliability. The researchers conducted two examinations at various times and compared their results. The tool's reliability was evaluated using the split-half method and Karl Pearson's coefficient of correlation formula, yielding a reliability score of 0.99, which indicates it is very reliable.

Procedures

Procedures for both groups (experimental and control groups): Evaluating the vital signs of preterm infants (temperature, heart rate, respiratory rate), along with their feeding, crying, and sleeping patterns.

- Examining the attachment between mothers and their preterm infants.
- Assessing mothers' satisfaction regarding their preterm babies.

Procedures for KMC (experimental group): KMC was conducted only after the mothers were thoroughly informed about its nature and purpose, and verbal consent was obtained. The researchers explained the nature, objectives, benefits, and effects of the intervention to all participating mothers and provided them with a booklet prepared by them. The researchers then readied both mothers and preterm infants by wrapping premature babies in blankets and handing them to their mothers. Preterm newborns were transferred from the incubator to the KMC once the standard care was completed.

The KMC procedure consists of positioning preterm infants prone, skin-to-skin, and between the mother's breasts. All preterm infants were positioned upright at an angle of 30°–40 °. Their backs were shielded with a receiving blanket that was folded into quarters and placed under the mother's cover gown to maintain a stable temperature. Both the mothers and preterm infants were seated in a chair in the feeding room.

- Mothers were advised to rest during KMC and breastfeed their preterm newborns.
- Assessing the type of feeding of premature infants during KMC.
- Assessing the bond between mothers and their premature newborns.

Mothers and preterm infants participated in 60 minutes of continuous KMC. Subsequently, the premature newborns were returned to their respective incubators. The evaluation included monitoring the infants' vital signs (temperature, heart rate, and respiratory rate), as well as assessing their crying and sleeping patterns. Finally, mothers' perceptions and thoughts regarding KMC were reviewed.

Procedures for Conventional or Routine Incubator Care (Control Group)

Helping the mother settle comfortably in a chair in the feeding area.

- Wrapping the premature infants in a blanket and presenting them to the mother.
- Assisting the mother in feeding the premature babies.
- Evaluating the type of feeding for preterm newborns.
- Evaluating the connection between mothers and premature newborns.
- Returning premature newborns to the incubator.
- The vital signs of preterm infants were assessed, including the temperature, heart rate, and respiratory rate.
- Assessing the crying and sleeping patterns of premature infants.

Finally, the researchers expressed their gratitude to the mother and presented her with the KMC booklet as a token of appreciation for her participation, encouraging her to continue practicing KMC [12].

RESULTS

KMC Assessment Flow Sheet

Frequency and Percentage Distribution of Preterm Babies in Both Groups According to Their Characteristics

The data collected shows that the majority of subjects 16 (53.3%) are male 14 (46.7%) are female in the experimental group, and 11 (36.6%) are male 19 (63.3%) are female.

Regarding gestational weeks, 4 (13.3%) were less than 32, 11 (36.6%) were 32 to less than 34 weeks, 15 (50) were 34 to less than 36 weeks, 14 (46.6%) were less than 32 weeks, 8 (26.6%) were 32 to less than 34 weeks, and 8 (26.6%) were 34 to less than 36 weeks in the control group.

Regarding birth weight, 5 (16.5%) were less than 1500 g, 4 (13.3%) were 1500–2500 g, 21 (70%) were 2000–2500 g in the experimental group, 7 (23.3%) were less than 1500 g, 13 (43.3%) were 1500–2500 g, and 10 (36.6%) were 2000–2500 g in the control group.

In the experimental group, 5 patients (16.6%) had a hospital stay of less than 3 days, 11 patients (36.6%) stayed for 3 to less than 6 days, 9 patients (30%) stayed for 6 to less than 9 days, and 5 patients (16.6%) stayed for more than 9 days. In the control group, 5 patients (16.6%) stayed for less than 3 days, 6 patients (20%) stayed for 3 to less than 6 days, 8 patients (26.6%) stayed for 6 to less than 9 days, and 11 patients (36.6%) stayed for more than 9 days.

Regarding the APGAR score, 10 (33.3%) were 7 and above, 19 (63.3%) were 4–6, 1 (3.33%) was below 3 in the experimental group, 15 (50%) were 7 and above, 15 (50%) were 4–6, and 0 (0%) were above 3 in the control group (Tables 1 and 2).

Table 1. Frequency and percentage distribution of mothers in both experimental and control groups according to their characteristics (N=60).

	Experimental Group		Control Group	
	n	***%***	***n***	***%***
1. Age in years				
a. less than 20 years	6	20.0	8	26.7
b. 20 to less than 30 years	20	66.7	22	73.3
c. 30 to less than 40 years	4	13.3	0	0
2. Level of education				
a. Illiterate	9	30.0	8	26.7
b. Read and write	5	16.7	0	0
c. Moderately educated	9	30.0	12	40.0
d. Highly educated	7	23.3	10	33.3
3. Employment				
a. Worked	20	66.7	17	56.7
b. Not worked	10	33.3	13	43.3
4. Parity				
a. less than 3	0	0	1	3.3
b. 3 to less than 4	11	36.7	5	16.7
c. more than 4	19	63.3	24	80
5. Type of delivery				
a. Normal vaginal delivery	10	33.3	14	46.7
b. Cesarean section	20	66.7	16	53.3

Table 2. Frequency and percentage distribution of preterm babies' physiological outcomes in both experimental and control groups (N=60).

Physiological outcomes	**Experimental group**				**Control group**			
	Pre-test		***Post-test***		***Pre-test***		***Post-test***	
	No	*%*	*No*	*%*	*No*	*%*	*No*	*%*
1. Heart rate (b/min)								
a. Bradycardia (<120)	1	3.3	5	16.7	0	0	0	0
b. Normal (120–150)	20	66.7	25	83.3	26	86.7	28	93.3
c. Tachycardia (>150)	9	30	0	0	4	13.3	2	6.7
2. Respiratory rate (b/min)								
a. Bradypnea (<35)	5	16.6	3	10	3	10	3	10
b. Normal (35–50)	24	80	27	90	23	76.7	24	80.0
c. Tachypnea (>50)	1	3.4	0	0	4	13.3	3	10
3. Temperature								
a. Hypothermia (<36.5)	13	43.3	2	6.7	2	6.7	3	10
b. Normal (36.5–37.2)	15	50	27	90	26	86.6	27	90
c. Hyperthermia (>37.2)	2	6.7	1	3.3	2	6.7	0	0
4. Weight gain (g)								
a. Less than 50 g	5	16.7	7	23.3	2	6.6	2	6.6
b. 50 to less than 100 g	10	33.3	11	36.7	24	80	24	80
c. more than100gms	15	50	12	40	4	13.3	4	13.3

Table 3. Comparison of the physiological outcomes among preterm babies before and after KMC application (N=30).

Aspect	Pre-test		Post-test		Paired 't'-test Value
	Mean	*Standard Deviation*	*Mean*	*Standard Deviation*	
Physiological outcomes	6.3	2.62	3.83	1.89	36.29*

The results indicated that the mean score for physiological outcomes in the pre-test was 6.3, with a standard deviation of 2.62. On the post-test, the mean pain level was 3.83, with a standard deviation of 1.89. A paired t-test value of 36.29 was statistically significant (, P<0.05) (Table 3).

Table 4. Mean, standard deviation, and independent 't'-test value of physiological outcomes after kangaroo mother care (N=60).

S.N.	Physiological outcomes	Post-test		't'-test value
		Mean	*Standard deviation*	
1	Experimental group post-test	8.98	3.26	9.316*
2	Control group post-test	5.65	3.03	

**Significant at level p<0.05*

Table 5. Frequency and percentage distribution of preterm babies' behavioral outcomes in both experimental and control groups (N=60).

Behavioral outcomes	Experimental group				Control group			
	Pre-test		*Post-test*		*Pre-test*		*Post-test*	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
1. Crying								
a. Shrill cry	26	86.7	2	6.7	8	26.7	6	20
b. High pitched cry	4	13.3	28	93.3	22	73.3	24	80
c. Low pitch cry								
b. Normal								
2. Sleep								
a. Quite sleep	3	10	22	73.3	2		4	13.3
b. Interrupted sleep	27	90	8	26.7	28		26	86.7
3. Feeding type								
a. Breastfeeding	17	56.7	20	66.7	5	16.7	5	16.7
b. Bottle feeding	13	43.3	10	33.3	25	83.3	21	83.3
1. ***Response to sound***								
a. Responds to pleasant sounds	4	13.3	7	23.3	3	10	3	10
b. Quiet	9	30	10	33.3	23	76.7	23	76.7
c. Attentive to your voice	17	56.7	13	43.4	4	13.3	4	13.3

Table 6. Comparison of the behavioral outcomes among preterm babies before and after KMC application (N=30).

Aspect	Pre-test		Post-test		Paired 't'-test Value
	Mean	*Standard deviation*	*Mean*	*Standard deviation*	
Behavioral outcomes	6.1	1.79	3.83	1.77	33.39*

Table 7. Distribution of preterm babies' psychosocial outcomes regarding their mothers' attachment and satisfaction in both groups (N=60).

Psychological outcomes	Experimental group				Control group			
	Pre		*Post*		*Pre*		*Post*	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
1. Mother-infant attachment (bonding)								
a. Positive attachment	16	53.3	29	96.6	10	33.3	10	33.3
b. Negative attachment	14	46.6	1	3.3	20	66.6	20	66.6
2. Mother's satisfaction								
a. Satisfied	20	66.6	30	100	8	26.6	8	26.6
b. Dissatisfied	10	33.3	0	0	22	73.3	22	73.3
3. Mother's perception								
a. Confident when caringand touching baby	8	26.6	8	26.6	20	66.6	30	100
b. Do not have information.Need adequate informationregarding KMC	22	73.3	22	73.3	10	33.3	0	0

Table 8. Comparison of the psychological outcomes among preterm babies before and after KMC application (N=30).

Aspect	Pre-test		Post-test		Paired 't'-test value
	Mean	*Standard deviation*	*Mean*	*Standard deviation*	
Psychological outcomes	1.3	1.20	8.2	1.39	21.7*

Table 9. Mean, standard deviation, and independent 't'-test value of psychological outcomes after kangaroo mother care.

S.N.	Psychological outcomes	Post-test		't'-test value
		Mean	*Standard deviation*	
1	Experimental group post-test	2.76	0.90	26.7*
2	Control group post-test	9.3	0.91	

Table 10. Association between Mothers' Characteristics and their preterm babies' Attachment in the experimental group (N=60).

Mothers' demographic characteristics	Maternal-Infant attachment					Level of significance
	Positive attachment		*Negative attachment*		*Chi-square*	
	No	*%*	*No*	*%*		
1. Age in years						
a. less than 20 years	0	0	2	8	2.48	S
b. 20 to less than 30 years	11	44	8	32		
c. 30 to less than 40 years	2	8	7	23		
2. Level of education						
a. Illiterate	4	16	4	16	2.32	NS
b. Read and write	2	8	2	8		
c. Moderately educated	5	20	3	12		
d. Highly educated	2	8	8	27		
3. Employment						
a. Worked	4	16	4	16	0.19	S
b. Not worked	9	36	13	43		

Table 11. Association between mothers' characteristics and their satisfaction in theexperimental Group using the Chi-square test (N=60).

Mothers' demographic characteristics	Maternal satisfaction					Level of significance
	Satisfied		*Dissatisfied*		*Chi-square test*	
	No.	*%*	*No*	*%*		
1. Age in years						
a. less than 20 years	0	0	2	4	3.83	S
b. 20 to less than 30 years	10	40	6	24		
c. 30 to less than 40 years	5	20	7	23		
2. Level of education						
a. Illiterate	4	16	4	16	1.29	NS
b. Read and write	2	8	2	8		
c. Moderately educated	6	24	2	8		
d. Highly educated	3	12	7	23		
3. Employment						
a. Worked	5	20	8	27	0.33	NS
b. Not worked	10	40	7	28		
4. Parity						
a. Less than 3	10	40	6	24	0.11	NS
b. 3 to less than 4	5	20	9	30		
c. more than 4	0	0	0	0		
5. Type of delivery						
a. Normal vaginal delivery	8	32	9	36	3.90	S
b. Cesarean section	7	28	6	20		

DISCUSSION

The current study found a significant difference between the mean scores of the pre-test and post-test mean scores. This indicates that KMC effectively improved preterm babies' physiological, behavioral, and psychosocial outcomes. The physiological outcomes among preterm babies before and after KMC application, the mean value in the pre-test, the mean value of physiological outcomes was 6.3 with a standard deviation of 2.62 and the post-test mean value was 3.83 with a standard deviation of 1.89. The paired t-test value obtained 36.29 was significant ($P<0.05$). The mean value for the post-test was 8.98, the standard deviation was 3.26, the mean pre-test value was 5.65, and the standard deviation was 3.03. The tabulated 't'-value was 1.77 and the obtained 't'-value was 9.316, which was significant at $p<0.05$.

In the pre-test, the mean value for behavioral outcomes was 6.1 with a standard deviation of 1.79, whereas the post-test mean value for pain level was 3.83 with a standard deviation of 1.77. The paired t-test yielded a value of 33.39, which was statistically significant at $P<0.05$.

For psychological outcomes, the pre-test mean was 1.3 with a standard deviation of 1.20, whereas the post-test mean increased to 8.2 with a standard deviation of 1.39. The paired t-test yielded a value of 21.7, which was statistically significant at $P<0.05$ (Tables 4–11).

CONCLUSION

The results indicated that KMC significantly enhanced the physiological stability, behavioral organization, and psychosocial outcomes of premature infants compared to those receiving traditional care. Additionally, skin-to-skin contact offers mothers a greater sense of well-being, personal fulfillment, and increased confidence in caring for their infants.

Conflict of Interest

The authors have no conflicts of interest regarding this research study.

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