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* **Corresponding author**.

lisa.chadha21@gmail.com

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Enhancing Maternal Knowledge and Attachment: Impact of an Information Module on Kangaroo Mother Care in Low-Birth-Weight Infants

Rajput Ankita[1], Chadha Lisa[2]*, Kulpooja [3]

1 M.Sc. Nursing student, Faculty of Nursing, SGT University, Haryana, India
2 Nursing Tutor, All India Institute of Medical Sciences, Vijaypur, Jammu & Kashmir, India
3 Associate professor, Faculty of Nursing, SGT University, Haryana, India

Abstract

Background: Despite significant progress in the past decade, many countries still struggle to ensure the survival, health, growth, and neurological development of preterm and low-birth-weight infants. New mothers often face numerous challenges when caring for their delicate newborns. **Material and Method:** A quasi-experimental research design was employed, utilizing a non-equivalent pretest-posttest approach. The researcher used a purposive sampling technique to recruit 62 mothers of low-birth-weight babies, who were then divided into two groups: 31 mothers in the control group and 31 mothers in the experimental group. The control group received no intervention, while the experimental group received knowledge through an information module on kangaroo mother care. **Results:** In the pretest, the majority (90.3%) of the control group had inadequate knowledge, while (19.4%) of the experimental group had moderate knowledge. In the post-test, the majority (87.1%) of the control group still had inadequate knowledge, but (83.9%) of the experimental group had adequate knowledge. A statistically significant improvement in knowledge scores in the experimental group (from 5.90 $\pm$1.75 to 12.00 $\pm$1.50), compared to a minor increase in the control group (from 5.35 $\pm$1.68 to 5.83 $\pm$1.71) after the implementation of the informational module in the experimental group. There are no significant associations between knowledge scores and socio-demographic variables ($p \leq 0.05$). **Conclusion:** The information module regarding kangaroo mother care significantly improved knowledge and maternal attachment among postnatal mothers. This underscores the effectiveness of targeted educational interventions in enhancing maternal care practices for preterm and low-birth-weight infants.

Keywords: Information module; Kangaroo mother care; Low-birth-weight babies; Maternal attachment; Postnatal mother; Pre-term baby

1 Introduction

Globally, preterm birth and low birth weight (LBW) pose significant health challenges, leading to elevated rates of neonatal death and illness.[1] According to the World Health Organization, roughly 15% of all babies born alive are classified as LBW, amounting to approximately 20 million infants each year worldwide.[2] In resource-limited settings, the prevalence of LBW can be even higher, reflecting disparities in maternal health and access to adequate prenatal care.[3]

Infants born with a weight under 2,500 grams, irrespective of their gestational age (LBW), or those delivered prior to 37 weeks of gestation (preterm), face an increased likelihood of both immediate and long-term health issues.[4] These babies are more susceptible to various complications, including respiratory problems, susceptibility to infections, and difficulties in maintaining body temperature and feeding issues.[5]

The effective management of newborns, especially those who are low birth weight (LBW) and preterm, requires comprehensive care strategies.[6] One such strategy is Kangaroo Mother Care (KMC), which involves skin-to-skin contact and exclusive breastfeeding. KMC is essential for improving health outcomes in LBW and preterm infants by stabilizing their physiological conditions and strengthening maternal-infant bonding.[7] This method helps meet the infant's biological needs by providing warmth, affection, and nutrition while also reducing the risks of hypothermia and hypoglycemia.[8] KMC can prevent prolonged hospitalization and is a cost-effective approach to reducing infant mortality and morbidity rates.[9] Additionally, it supports cognitive development, enhances mother-child bonding, boosts maternal confidence in infant care, and decreases stress for both mother and baby.[10] KMC is more practical and affordable than incubators, offering benefits such as reduced infection rates, improved weight gain, and better overall development.[11]

The early postnatal period is crucial for LBW infants, significantly influencing their developmental trajectory and overall health outcomes.[12] One critical aspect of postnatal care is the establishment of effective mother-infant bonding, which plays a pivotal role in promoting the infant's emotional and physical development.[13] The strong postnatal attachment is also associated with improved feeding behaviors, better weight gain, and a decreased incidence of neonatal complications for mothers of LBW and preterm infants, establishing a robust attachment can be particularly challenging due to the stress and medical complications associated with their infants' conditions.[14,15] Kangaroo Mother Care can alleviate maternal anxiety and stress, thereby fostering this important bond.

Despite significant progress over the past decade, challenges remain in ensuring the survival, health, growth, and neurological development of preterm and LBW infants in many countries.[16] Research from various income-level countries shows that KMC effectively promotes weight gain and improves health outcomes in LBW infants.[17] However, data on LBW infants in underdeveloped regions is often scarce, as many deliveries occur in homes or small health facilities, leading to frequent underreporting of LBW cases.[18]

The benefits of KMC are well-documented, but its implementation remains inconsistent, especially in areas with limited maternal knowledge and awareness.[19] Educational modules designed to inform mothers about KMC can address this gap, offering crucial knowledge and encouraging the practice of KMC.

This study aims to evaluate the impact of an information module on postnatal attachment and KMC knowledge among mothers of LBW infants. The findings may contribute to providing valuable insights for refining educational strategies and developing more effective interventions, ultimately improving health outcomes for LBW and preterm infants.

2 Materials and Methods

2.1 Study design and settings

The present study employed quasi-experimental research design, utilizing a non-equivalent pretest-posttest approach. The sample was drawn from the postnatal ward of the District Civil Hospital in Gurugram, Haryana. This location was chosen due to its convenience, adherence to the study protocols, and the availability of an appropriate target population.

2.2 Study Participants and sampling

The study targeted postnatal mothers of low-birth-weight infants admitted to the Neonatal Intensive Care Unit (NICU) and the postnatal ward of the District Civil Hospital, Gurugram, Haryana. A purposive sampling method was used to recruit 62 postnatal mothers, who were divided into two groups: 31 in the control group and 31 in the experimental group. The data was collected from August 2023- September 2023.

2.3 Data collection technique

The researcher employed a mixed-method approach for data collection, utilizing hospital records, self-administered tools, and direct participant interaction. Data was first obtained from hospital records to identify postnatal mothers who had delivered low birth weight (LBW) babies and were either admitted to the postnatal ward or had babies in the Neonatal Intensive Care Unit (NICU). The identified mothers were then approached, and the purpose of the study was explained to them. To gather data, the participants were given a self-administered bilingual questionnaire (English and Hindi language), which included a demographic questionnaire, a knowledge assessment on Kangaroo Mother Care (KMC),

and a postnatal attachment assessment scale. They were allotted 15 minutes to complete the questionnaire independently. Afterward, the mothers were randomly assigned to one of two groups: the experimental group, where they received one-on-one education on KMC with the help of a photo booklet aimed at enhancing their knowledge. On the third day, these mothers were approached again and asked to complete the same knowledge questionnaire to assess any improvement. In contrast, the control group did not receive any additional knowledge intervention, and the same questionnaire was used to obtain the data.

2.4 Development and description of the tool

This data collection tool comprises three distinct sections:

- **Section A: Socio-demographic Profile**

This section gathered personal information about the postnatal mother's age, literacy, marital status, occupation, monthly income, type of family, locality, religion, preterm baby weight, gravida, type of delivery, and knowledge about Kangaroo Mother care (KMC).

- **Section B: Structured Knowledge Questionnaire**

This section assessed postnatal mother knowledge regarding Kangaroo Mother care (KMC) through a 20-item multiple-choice questionnaire. Each correct answer was awarded one point, resulting in a total score ranging from 0 to 20. Knowledge levels were categorized as follows: Poor Knowledge (0-7), Average Knowledge (8-14), Good Knowledge (15-20).

- **Section C: Maternal Postnatal Attachment Scale**

This section evaluated postnatal attachment by using a standardized tool developed by Condon and Corkindale at Flinders University, which is a validated tool used to assess the maternal emotional bond with newborns. The 19-item scale measures three dimensions: quality of attachment, absence of hostility, and pleasure in interaction, with responses scored on a Likert scale ranging from 1 to 5. Total scores range from 19 to 95, with higher scores indicating stronger positive attachment. Scores below 50 may indicate difficulties in the maternal-infant bond.[20] The permission to utilize scale in the present study is obtained from the author.

2.5 Ethical considerations

There were no ethical problems encountered during the Pilot study conducted before final data collection. The medical Superintendent of Peri-urban Teaching Hospital in Haryana gave his consent. Prior authorization was also obtained from members of the Shree Guru Gobind Singh Tricentenary University's ethics council (IEC-SGTDCHRI/FNUR/2024/01). The participant consent was acquired before data collection, and they were informed that the data would be kept confidential. The individuals were also informed that their involvement in the study was voluntary and that they may opt out at any moment.

2.6 Statistical analysis

The collected data was organized by Google Sheets (Google LLC, Mountain View, CA, USA) and transferred to Excel sheets (Microsoft Corporation, Redmond, WA, USA) and all statistical analyses were performed by using Statistical Package for Social Sciences (SPSS) version-20 (IBM Corp., Armonk, NY, USA). Descriptive statistics were calculated for socio-demographic characteristics and were presented using frequency and percentage. The Chi-square test was used to determine the correlation between socio-demographic variables and pre-test scores. The effectiveness was evaluated using a paired t-test. A p-value of <0.05 was considered statistically significant.

3 Results

Table 1 depicts that the majority of post-natal mothers have completed 10th-class education. All in the experimental group were married, while 83.9% in the control group were married. Most participants were housemakers, with 100% in the control group. The majority had a monthly income of ₹17,001-35,000 and lived in nuclear families in rural areas. Most were Hindu, and many of the preterm infants weighed 1.6-2 kg. The majority were primigravida, with most deliveries being normal vaginal with episiotomy. None had heard of kangaroo mother care.

Table 2 describes that in the control group, the majority had inadequate knowledge both in the pre-test (90.3%) and post-test (87.1%). Only a small increase in moderate knowledge was observed from 9.7% to 12.9%. No participants had adequate knowledge in either test. In the experimental group, 80.6% had inadequate knowledge in the pre-test, but this dropped to 0% in the post-test. Conversely, the percentage with adequate knowledge increased significantly from 0% in the pre-test to 83.9% in the post-test, while those with moderate knowledge slightly decreased from 19.4% to 16.1%.

Table 3 revealed that in the pre-test, both the control and experimental groups had similar scores acrossthe quality of attachment, absence of hostility, and pleasure in interaction. However, in the post-test, the experimental group showed significant improvements in quality of attachment increased to 20.96 ± 0.091, absence of hostility to 35.48 ± 1.38, and pleasure in interaction to 18.48 ± 0.56. In contrast, the control group showed minimal changes, indicating a substantial positive effect in the experimental group.

Table 4 describes that in control group exhibited a slight increase in knowledge from pre-test (5.35 ± 1.68) to post-

Table 1. Distribution of respondents according to Socio-demographic variable (N=62)

Variable	Control Group (31)		Experimental Group (31)	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Age in years				
18 to 25 years	15	48.4	14	45.2
26 to 36 years	16	51.6	17	54.8
Literacy				
No formal education	3	9.7	3	9.7
10^{th} Class	18	58.1	19	61.3
12^{th} Class	10	32.3	8	25.8
Graduation	0	0	1	3.2
Marital status				
Married	26	83.9	31	100
Widow	5	16.1	0	0
Occupation				
House Maker	31	100	27	87.1
Private Job	0	0	4	12.9
Monthly income				
Less than 17000	7	22.6	11	35.5
17001 to 35000	24	77.4	20	64.5
Type of family				
Joint	5	16.1	3	9.7
Nuclear	26	83.9	28	90.3
Locality				
Rural	27	87.1	29	93.5
Urban	4	12.9	2	6.5
Religion				
Hindu	24	77.4	27	87.1
Muslim	2	6.5	3	9.7
Sikh	5	16.1	1	3.2
Weight of the preterm				
$\leq$ 1.5Kg	1	3.2	1	3.2
1.6 – 2Kg	18	58.1	23	74.2
More than 2Kg	12	38.7	7	22.6
Gravida				
Primigravida	18	58.1	16	51.6
Multigravida	13	41.9	15	48.4
Type of delivery				
Normal Vaginal delivery with episiotomy	17	54.8	19	61.3
Normal Vaginal delivery without episiotomy	11	35.5	11	35.5
Lower segment Cesarian Section	3	9.7	1	3.2
Have you heard about kangaroo mother care?				
Yes	0	0	0	0
No	31	100	31	100

Table 2. Knowledge

Groups	Level of knowledge	Score	Pre-test		Post-test	
			Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Control group	Adequate	1 - 7	0	0	0	0
	Moderate	8 -10	3	9.7	4	12.9
	Inadequate	11 - 14	28	90.3	27	87.1
Experimental group	Adequate	1 - 7	0	0	26	83.9
	Moderate	8 - 10	6	19.4	5	16.1
	Inadequate	11 - 14	25	80.6	0	0

Table 3. Maternal Attachment Among Postnatal Mothers (N=62)

Test	Group	Control group		Experimental group	
		Mean	SD	Mean	SD
Pre-test	Quality of attachment	8.48	1.20	8.29	1.34
	Absence of hostility	17.12	1.40	16.74	1.87
	Pleasure in interaction	8.51	1.02	8.61	1.11
Post-test	Quality of attachment	8.90	1.04	20.96	0.091
	Absence of hostility	17.19	1.32	35.48	1.38
	Pleasure in interaction	7.83	1.00	18.48	0.56

Table 4. Effectiveness of the information module on the knowledge regarding kangaroo mother care among post-natal mothers (N=62)

Group	Test	Mean	SD	T Value	P Value	Df
Control Group	Pre-test	5.35	1.68	2.70	0.011*	30
	Post-test	5.83	1.71			
Experimental Group	Pre-test	5.90	1.75	16.388	0.000*	30
	Post-test	12.00	1.50			

test (5.83 $\pm$1.71), with a t-value of 2.70 and a p-value of 0.011, indicating statistically significant improvement. In contrast, the experimental group demonstrated a substantial gain in knowledge, with pre-test scores of (5.90 $\pm$1.75) rising to (12.00 $\pm$ 1.50) post-test, yielding a t-value of 16.388 and a p-value of 0.000, reflecting a highly significant effect. This demonstrates that the information module significantly improved knowledge of kangaroo mother care in the experimental group relative to the control group.

Table 5 shows that the control group exhibited minimal changes inthe quality of attachment, absence of hostility, and pleasure in interaction from pre-test to post-test, with p-values indicating no significant improvement. In contrast, the experimental group demonstrated significant gains across all measures. Quality of attachment increased from a pre-test mean of (8.29 $\pm$1.34) to a post-test mean of (20.96 $\pm$ 0.91); absence of hostility rose from (16.74 $\pm$ 1.87) to (35.48 $\pm$ 1.38); and pleasure in interaction improved from (8.61 $\pm$ 1.11) to (18.48 $\pm$ 0.56). All changes in the experimental group were statistically significant (p-values < 0.001), confirming the effectiveness of the module in enhancing maternal attachment.

Table 6 shows the relationship between knowledge regarding mother care and maternal attachment. The correlation between knowledge and maternal attachment is +0.06 which indicates a Positive low correlation in the pre-test, similarly, the post-test score is -0.124 which indicates a negative low correlation in the control group. The correlation between knowledge and maternal attachment is -0.134 which indicates a negative low correlation in the pre-test but after the intervention, the post-test score is +0.05 which indicates a positive low correlation in the experimental group.

Table 7 shows the association between knowledge score with selectedsocio-demographic variables. The obtained P-value for Age (in Years), literacy, Marital Status, occupation, monthly income, type of family, Locality, religion, the weight of the preterm, Gravida, and type of delivery, have you heard about kangaroo mother care is more than the level of significance i.e. 0.05, which indicates that there is no significant association between knowledge score with selected socio-demographic variables.

Table 5. Effectiveness of the information module on maternal attachment among post-natal mothers (N=62)

Group	Areas	Test	Mean	SD	T Value	P Value
Control group	Quality of attachment	Pre-test	8.48	1.20	1.686	0.102
		Post-test	8.90	1.04		
	Absence of hostility	Pre-test	17.12	1.40	0.166	0.869
		Post-test	17.19	1.32		
	Pleasure in interaction	Pre-test	8.51	1.02	-2.35	0.025
		Post-test	7.83	1.00		
Experimental group	Quality of attachment	Pre-test	8.29	1.34	41.989	0.000**
		Post- test	20.96	0.91		
	Absence of hostility	Pre-test	16.74	1.87	43.337	0.000**
		Post- test	35.48	1.38		
	Pleasure in interaction	Pre-test	8.61	1.11	41.161	0.000**
		Post- test	18.48	0.56		

Table 6. Relationship between knowledge regarding kangaroo mother care and maternal attachment (N=62)

Group	Test	Area	Mean	SD	Correlation
Control group	Pre-test	Knowledge	5.35	1.68	+0.06
		Maternal attachment	34.12	1.91	
	Post-test	Knowledge	5.83	1.71	-0.124
		Maternal attachment	34	1.76	
Experimental group	Pre-test	Knowledge	5.90	1.75	-0.134
		Maternal attachment	33.64	2.41	
	Post-test	Knowledge	12.00	1.50	+0.051
		Maternal attachment	74.93	1.74	

4 Discussion

The study findings suggest that postnatal mothers in the experimental group showed significant improvements in knowledge and attachment compared to the control group after receiving an informational module. The results of the current study indicate that in the pre-test 90.3% of the participants in the control group and 80.6% of the participants in the experimental group had insufficient knowledge about Kangaroo Mother Care (KMC). In the control group, a maximum of 87.1% of the participants had inadequate knowledge. In contrast, in the experimental group, 83.9% of the participants had adequate knowledge about KMC after the implementation of the information module. The results aligned with a study conducted by Lawal et al., which showed that mothers who underwent KMC training retained better knowledge and were more likely to practice it while caring for their low-birth-weight infants.[21] This improved neonatal outcomes, such as weight gain, successful breastfeeding, and reduced hospital stays. Mothers of premature or low birth weight (LBW) infants often encounter difficulties in forming early attachment due to extended hospital stays, anxiety, and stress.[22] Premature births and low birth weight (LBW) often require extended stays in the neonatal intensive care unit (NICU), which can physically separate the mother and infant during critical bonding periods.[23] This separation, along with the medical complexities and uncertainties surrounding the infant's health, often leads to increased maternal anxiety and stress, further complicating the attachment process.[24]

The study results show that the experimental group had a significantly improved postnatal maternal attachment compared to the control group. The experimental group had a lower absence of hostility, with a mean score of 16.74 $\pm$ 1.87, compared to the control group's mean score of 17.12 $\pm$ 1.40. In the posttest, the experimental group's mean score further decreased to 35.48 $\pm$ 1.38, indicating even less absence of hostility compared to the control group's mean score of 17.19 $\pm$ 1.32. The findings align with a study by Mehrpisheh et al., indicating that kangaroo mother care (KMC) not only enhances infants' physical health but also fosters emotional bonding between mother and baby.[25] The close physical contact involved in kangaroo mother care (KMC) has been shown to have a positive impact on maternal sensitivity and attachment behaviors, helping to alleviate the emotional distress often experienced by mothers of preterm infants.[26] The skin-to-skin contact and emotional connection encouraged by kangaroo mother care (KMC) have been proven to strengthen the bond between mother and infant, decrease maternal anxiety, and improve the mother's capacity

Table 7. Findings related to the association between the posttest knowledge score of the control group with selected demographic variables

Variable	Inadequate	Moderate	Total	df	Chi-square value	P value
Age in years						
18 to 25 years	14	1	15	1	0.301	0.583
26 to 36 years	14	2	16			
Literacy						
No formal education	3	0	3			
10^{th} Class	17	1	18	2	1.89	0.389
12^{th} Class	8	2	10			
Marital status						
Married	23	3	26	1	0.639.	0.424
Widow	5	0	5			
Occupation						
House Maker	28	3	31			
Monthly income						
Less than 17000	7	0	7	1	0.969	0.325
17001 to 35000	21	3	24			
Type of family						
Joint	5	0	5	1	0.639	0.424
Nuclear	23	3	26			
Locality						
Rural	25	2	27	1	1.234	0.267
Urban	3	1	4			
Religion						
Hindu	22	2	24	2	0.873	0.646
Muslim	2	0	2			
Sikh	4	1	5			
Weight of the preterm						
$\leq$ 1.5Kg	1	0	1			
1.6 – 2Kg	17	1	18	2	1.128	0.569
More than 2Kg	10	2	12			
Gravida						
Primigravida	17	1	18	1	0.834	0.361
Multigravida	11	2	13			
Type of delivery						
Normal Vaginal delivery with episiotomy	16	1	17			
Normal Vaginal delivery without episiotomy	9	2	11	2	1.512	0.47
Lower segment Cesarian Section	3	0	3			
Have you heard about kangaroo mother care?						
No	28	3	31			

to meet the infant's needs.[27] These results align with a study by Conde-Agudelo et al., which showed that kangaroo mother care (KMC) led to a significant decrease in neonatal mortality rates, particularly in low-resource environments.[28]

The study found a strong positive correlation (+0.051) between knowledge and maternal attachment, highlighting the link between knowledge and emotional bonding. When mothers have a better understanding of how to care for their preterm infants, they are more likely to form a secure attachment, which is crucial for the infant's emotional and physical development.

The lack of significant associations between socio-demographic variables (such as age, literacy, income, and family structure) and knowledge scores suggests that the educational module was effective across diverse demographic backgrounds. This finding aligns with a study by Maleki et al., showing the universal applicability of educational interventions in improving maternal care practices, irrespective of socio-demographic factors.[29] This is particularly important in settings where maternal literacy levels and healthcare access may vary significantly, indicating that even brief, targeted interventions can have a meaningful impact on maternal behaviors and outcomes.

Preterm births and low birth weight (LBW) infants are significant factors in neonatal health, especially in areas with limited resources.[30] Kangaroo Mother Care (KMC) is known to improve neonatal outcomes but faces challenges in implementation due to mothers' lack of knowledge and awareness. Additionally, mothers of LBW infants may experience compromised maternal-infant attachment due to heightened anxiety and stress. This study aims to assess how structured educational interventions, such as information modules on KMC, can enhance maternal knowledge and improve postnatal attachment, ultimately leading to better neonatal outcomes.

4.1 Limitations

The findings of the study may not apply to a larger population due to the small sample size. The short-term nature of the study prevents the assessment of long-term outcomes. The study was conducted in a single hospital, so the results may not apply to other settings, especially in rural areas with limited healthcare and educational resources.

5 Conclusion

The study shows that introducing an information module on KMC can significantly increase maternal knowledge and postnatal attachment among mothers of LBW infants. These results emphasize the important role of educational interventions in empowering mothers to follow best practices in neonatal care and improving the bond between mother and infant. Policymakers and healthcare providers should consider incorporating structured educational programs like the KMC module into standard postnatal care protocols, especially in resource-limited settings, to enhance outcomes for both mothers and infants.

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