



Original Research

Attachment between Mother and Premature Baby: A quasi-Experimental Study

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Abstract:

Background: Preterm birth represents a global health concern. Maternal attachment is the foundation for the relationship of the mother and newborn. It promotes the healthy development of the newborn and influence the physical and mental growth of the newborn. Kangaroo Mother Care (KMC) promotes maternal-newborn attachment and emotional connection and extend beyond the neonatal period.

Objective: This study aims to evaluate the effectiveness of KMC on maternal attachments of mothers with premature newborns.

Methods: This quasi-experimental study was performed on 50 mothers of premature newborns who were admitted to neonatal intensive care unit and Kangaroo Mother Care Unit. A questionnaire comprising demographic information and the Attachment scale between Mother and Newborn Children were used as data collection tools. All data analysis was performed using Jamovi software version 25. Significant level is considered $P < 0.05$.

Results: After the intervention, the levels of maternal attachment of mothers in the intervention group were significantly higher than in the control group (47.7 ± 2.9 vs. 40.4 ± 5.4 , $P = 0.003$). After the intervention, the newborns in the intervention group have a significantly higher number of breastfeeding than the control group (10.6 ± 1.8 vs. 8.2 ± 1.6 , $P = 0.000$). Moreover, the newborn of the intervention group had a statistically significant higher weight at discharge time (2164.4 ± 481.1 vs. 1965.2 ± 372 , $P = 0.042$).

Conclusion: KMC improves the newborn-maternal attachment scores compared to the conventional care. Additionally, it improved the breastfeeding and weight gain of the preterm newborns

Keywords: Kangaroo mother care, maternal attachment, neonate, prematurity.

Introduction:

Preterm birth represents a global health concern. Preterm birth rates have reportedly ranged from 5% to 7% of live births in some developed countries, yet they are significantly higher in developing countries. ^[1,2] A premature-born baby is often vulnerable to different problems. ^[3] The NICU setting and the isolation of the newborn from their mothers leading to an interruption in the attachment and bonding processes and limiting their visual and physical connection. ^[4] Maternal attachment is a unique bond that is shaped within the first days following delivery and is the foundation for the relationship of the mother and newborn. It promotes the healthy development of the newborn and influence the physical and mental growth of the newborn. ^[5]

Premature births complications may be preventable through evidence-informed, low-cost interventions. One such intervention is Kangaroo Mother Care (KMC), which is a practical method needed as an alternative to substitute incubators with efficient and effective treatment. This technique involves continuous skin-to-skin contact between the newborn and mother or a substitute person, exclusive breastfeeding whenever possible, and early discharge with the newborn in a kangaroo position with a strict follow-up. ^[2,6] The benefits of KMC include improvement of breastfeeding initiation and maintenance, parent mental health, bonding, attachment, newborn cardiorespiratory stability, brain maturation, warmth, and development. KMC promotes maternal-newborn attachment and emotional connection through the release of oxytocin. The positive effects of KMC on maternal-newborn attachment extend beyond the neonatal period. It enhances maternal sensitivity, responsiveness, and confidence in caregiving, leading to secure attachment and positive long-term outcomes for preterm newborns. ^[7,8] The conflict between traditional care and KMC revolves around the effectiveness, challenges in implementation, and potential integration of both approaches. While KMC has shown promising results, the feasibility of its widespread adoption may be influenced by various factors. Hence, we

conduct this study aiming to evaluate the practice of Kangaroo Mother Care, and its effects on maternal-newborn attachment.

Methods:

In this quasi-experimental study, 50 mothers of premature newborns who were admitted to the neonatal intensive care units of Al- Zahraa Teaching Hospital, AL-Najaf AL-Ashraf City / central Iraq., from May 2023 to March 2024, have participated. The study was approved by the ethics committee of a consent granted by the University of Kufa's Faculty of Medicine's Ethics Written informed consent was obtained from mothers after explaining to them the process of the study. purposive sampling was used to determine the sample size. Using the following formula,

Inclusion Criteria:

Premature newborn with a gestational age of fewer than 37 weeks, Weight at birth less than 2000 grams being admitted to intensive care unit and kangaroo care unit with stable conditions, having no birth defects, Newborns receiving phototherapy may be assessed for intermittent KMC, also having no history of using mechanical ventilation and surgery, The mother's willingness to offer KMC, having no history of mental disorder were defined as inclusion criteria.

Study Intervention:

Data collection was done through a questionnaire. containing demographic information and attachment between mothers and newborn children scale.

Construction and Application Kangaroo Mother Care:

The newborn was placed almost naked (except for a cap, nappy, and socks) between the mother's breasts, in a strictly vertical position, with his belly in direct contact with his mother's skin, his head turned to the side, his arms and legs spread out. At first, the researcher explained the study purpose for mothers and asked them for voluntary participation to formal written informed consent of willing mothers was obtained for participation

in the study. And explain method of data collection the mothers were counseled was presented as follows as daily sessions:

1. Admission Counselling
2. Skin to Skin contact (SSC) Technique (SSC Duration, Benefits)
3. Breast feeding Technique (Exclusive Breast-Feeding, Breast-feeding benefits and Duration, Frequency of breast feeding)
4. Sanitation & Hygiene Practices
5. Danger Signs of neonate illness
6. Follow Up Visit in KMC Unit

The Routine Daily Counselling Contents care was constructed depending on kangaroo mother care practical guide by World Health Organization Reproductive Health. after translation to Arabic language and kangaroo mother care pocket guide for health care providers, ministry of health. Iraq was dependable as guide when training participant. Also, the KMC content were displayed as video

Mothers of the experimental group were trained for performing KMC for 45 minutes twice daily for one week. The responsible researchers supervised the performance of the included mothers. As for the control group, normal care was performed by the mothers. Maternal attachment was measured at the time of hospitalization (the pretest) and after one month of hospitalization (the post-test).

Attachment scale between Mother and Newborn Children:

The attachment between mother and newborn children scale measures the Attachment level between mother and preterm newborn. It is a self-rated scale used to measure Attachment between parents and newborn children whose use favors the practice of evidence-based nursing in diverse contexts such as Neonatal Care Units and in ambulatory practice. The scale contains 24 items rated on a 5-point Likert scale from “Very intensely, Intensely, Moderately, Slightly, definitely not”. For the interpretation of the results, a total score less than or equal to 85 points

indicates low affective attachment between mothers and newborn children, a score between 86 and 89 points indicates a medium or moderate affective attachment between parents and newborn children, and when the total score is higher than 90 points, the affective attachment between parents and newborn children is high.^[9]

Cultural Equivalence of an Instrument:

Two bilingual experienced used the back-translation procedure to translate the used questionnaire from English to Arabic. Another two independent translators back translated it

The validity of the scale:

A pilot study was conducted from the period of 24th August 2023 to the 20th September 2023, about a month before fieldwork. The pilot study was carried out on 10 % of the study sampling (5 premature newborns and their mothers) at the previously mentioned setting to test the study tools for the clarity and time required to fill it.

The reliability analysis “Cronbach’s Alpha” was run to specify the internal consistency of the scale (attachment between mothers and newborn children scale). The reliability analysis tested on 5 parents of children, and the results showed a Cronbach’s Alpha value of (0.90) this results statistically acceptable for well-established instrument.

Sample Size Calculation:

The minimal required sample size was calculated based on the statistical software G*Power, based on the previous studies, ^[10,11] setting Power at 80% and α -error at 0.05. The sample size for each group was obtained 24 people and taking into account the possible loss of each group, 25 people were calculated, which was 50 people in total. The power was 80%, the first type error was 0.05, the sample volume ratio in the two groups (λ) was 1, the correlation coefficient between the repetitions (ρ) was 0.7, and the standardized effect size value (A_Plan) was assumed to be 0.7.

Statistical analysis

The statistical analysis was performed using Jamovi software. The normality of data was tested

by the Shapiro-wilk test and the data were not normally distributed, so non-parametric statistical tests like the Mann-Whitney U test was used to compare unpaired continuous data, Chi-square/Fisher's exact test to compare unpaired categorical data, and Wilcoxon signed-ranked test to compare paired continuous data. We performed univariate and multivariate linear regression analysis to investigate the factors that can predict the attachment outcome. Results were considered to be significant if P values were less than 0.05.

Results:

Scio-demographic characteristics of the included participants:

This study included 25 mothers for each group, all of them were married except for one divorced mother at the KMC group. As for their educational level, only 8% and 16% of them had higher educational level at the KMC and the control groups, respectively. Most of the included participants were housewives with higher rural residency in the KMC group and higher urban residency in the control group; **Table 1**. There was no significant difference between both groups regarding the obstetric history; **Table 2**. As for feeding history, KMC group has significantly higher incidence of exclusive breast feeding while the control group showed higher incidence of bottle feeding; **Table 3**.

The mean age in the kangaroo care group was 13.6 days compared to 11.9 days in the control group. Most of the newborns were males in the kangaroo group (56%) while most of them were females in the control group (52%). Most newborns were less than 1500 g in the kangaroo group (92%) while most of them were between 1500 to 2000 g in the control group (48%). There were no significant differences between both groups regarding age ($P = 0.22$) and gender ($P = 0.571$); however, the baseline neonatal weight of the Kangaroo mother care group was significantly less than the control group ($P < 0.001$); **Table 4-5**.

Attachment Scores.

The post-attachment score was significantly higher in the KMC group compared to the control group ($P < 0.001$). Also, the post-attachment score

significantly increased compared to the pre-value in only the Kangaroo mother care group ($P < 0.001$); **Table 6**.

Regression analysis of factors that can predict improvement in attachment score:

In the univariate linear regression model, the control group (not using kangaroo mother care), bottle feeding, and mix feeding decreased the attachment score improvement ($P = 0.015$, $P < 0.001$, and $P = 0.022$, respectively) while women with an intuitional educational level hand were associated with increased improvement compared to women who can't read ($P = 0.012$). Also, female neonates were associated with increased attachment scores compared to males ($P = 0.03$).

In multi-regression analysis, we found that only bottle feeding was associated with decreased attachment score improvement ($P = 0.037$) and women with institutional education were significantly associated with increased attachment scores compared to women who can't read or write ($P = 0.042$); **Table 7**.

Discussion:

In this study, we found that KMC was associated with significant improvement of maternal attachment scores. The post-attachment score was higher in the kangaroo mother care group compared to the control group. Also, the post-attachment score was significantly increased compared to the pre-value in only the Kangaroo mother care group. additionally, the change in attachment score was significantly increased in the kangaroo mother group compared to the control group.

As regards the feeding history of newborns in our study, we found that exclusively breastfeeding newborns were significantly higher in the Kangaroo mother care group compared to the control group with 75% vs 52%, respectively, in both groups ($P < 0.001$). in addition, we found that causes of refusal of breastfeeding like not staying with the baby through the day, having a fever, and due to cultural causes were significantly increased among the control group.

The baseline neonatal weight of the KMC group was significantly less than the control group as 92% of newborns were less than 1500 g in the KMC group, while most of them were between 1500 to 2000 g in the control group with 48%.

KMC plays a crucial role in promoting maternal attachment. The close physical contact and bonding experience during KMC facilitate the establishment of a strong emotional bond between the mother and her preterm newborn. This attachment has long-lasting effects on the mother-newborn relationship, leading to improved maternal mental health and increased parental confidence in caring for their baby. The sense of closeness and connection during KMC helps alleviate maternal anxiety and stress, promoting a nurturing and supportive environment for the newborn's development. [12]

In agreement with our results, gathwala et al., reported that the total attachment score in the KMC group was significantly higher than that obtained in the control group. Similarly, iran et al., reported that Mothers' attachment was assessed in both groups prior to the intervention, and the results indicated that there was no significant difference between the two groups ($P = 0.868$). However, following KMC, attachment score was significantly higher at the intervention group's Compared with the control group; ($P = 0.003$). [13,14]

In addition, Cho et al., suggested that kangaroo care positively influenced maternal–newborn attachment, as they reported that maternal–newborn attachment significantly changed at discharge after intervention. The KMC group had higher maternal–newborn attachment scores than the control group at discharge. [10]

Also, numerous studies have documented similar outcomes of improved bonding between mother and child with KMC. Tessier et al. evaluated the impact of Kangaroo mother care on mother-child attachment in a randomized controlled trial with 246 newborns weighing less than 2000 gm in the KMC group and 242 in the control group. They came to the conclusion that the KMC group had a

greater sense of competence and sensitivity. The mothers in the KMC group treated their children's discomfort better. Mothers of KMC children were also more frequently active in their babies' care in the index study. Additionally, they were noticeably more bonded to their children and picked them up more frequently when they cried. [15]

According to Kennell et al., a mother's attachment with her newborn is necessary for the child to develop and thrive while under the mother's care. [18] It could be supported by giving constant support during labor, holding the baby against the mother's skin on her chest, encouraging the mother to continue breastfeeding, and keeping the mother and child together. Skin-to-skin contact in the KMC group may have contributed to the mothers' higher attachment behavior in the overall study. [16]

In addition, we found that only bottle feeding was associated with decreased attachment score improvement and women with institutional education were significantly associated with increased attachment scores compared to women who can't read or write.

KMC encourages and supports breastfeeding, which is a powerful bonding experience between a mother and her baby. Breastfeeding releases hormones such as prolactin and oxytocin, which promote feelings of warmth and connection. The act of breastfeeding establishes a unique and intimate relationship between the mother and her newborn, strengthening the maternal attachment. [2]

Also, providing parents with education and training on KMC techniques, newborn care, and developmental milestones helps them understand their newborn's needs and abilities. Knowledge empowers parents to provide the best possible care for their preterm newborns, leading to increased attachment. Parental education also helps parents overcome fears and anxieties associated with caring for a preterm newborn, allowing them to build a stronger emotional connection. [17]

Table 1: Sociodemographic characteristics of the included participants

Variable		Kangaroo mother care group (N = 25)		Control group (N = 25)		P-value
		N	%	N	%	
Marital status	married	24	96.0%	25	100.0%	1.000
	divorced	1	4.0%	0	0.0%	
Educational level	Unable to read and write	2	8.0%	5	20.0%	0.278
	Only read	5	20.0%	1	4.0%	
	Read & write	7	28.0%	3	12.0%	
	Primary school	7	28.0%	8	32.0%	
	secondary	2	8.0%	3	12.0%	
	institute	0	0.0%	1	4.0%	
	College	2	8.0%	4	16.0%	
Occupation	housewife	23	92.0%	21	84.0%	0.378
	worked	1	4.0%	3	12.0%	
	student	1	4.0%	1	4.0%	
Monthly income	satisfied	4	16.0%	5	20.0%	0.302
	Satisfied to some extent	11	44.0%	15	60.0%	
	unsatisfied	10	40.0%	5	20.0%	
Residence	rural	13	52.0%	11	44.0%	0.571
	urban	12	48.0%	14	56.0%	
Family type	nuclear	5	20.0%	14	56.0%	0.009*
	extended	20	80.0%	11	44.0%	

Table 2: shows obstetric history of the mothers

Variables		Kangaroo mother care group (N = 25)		Control group (N = 25)		P-value
		N	%	N	%	
(Gravida) Number of pregnancies	primigravida	9	36.0%	9	36.0%	1
	multigravida	16	64.0%	16	64.0%	
Age of gestation	< 32	12	48.0%	13	52.0%	0.822
	32 < 34	10	40.0%	9	36.0%	
	34 ≤ 36	3	12.0%	3	12.0%	
Type of delivery	normal	5	20.0%	8	32.0%	0.333
	Cesarean section	20	80.0%	17	68.0%	

Table 3: shows the feeding history

Variable		Kangaroo mother care group (N = 25)		Control group (N = 25)		P-value
		N	%	N	%	
Feeding type	Exclusively breastfeeding	18	75.0%	4	16.0%	<0.001*
	Bottle feeding	2	8.3%	13	52.0%	
	Mixed feeding	4	16.7%	8	32.0%	
Reasons for refusing to breastfeed	My breast milk is not enough	4	100.0%	3	14.3%	0.007*
	I do not stay with the baby throughout the day	0	0.0%	10	47.6%	
	Mother has a fever	0	0.0%	2	9.5%	
	culture	0	0.0%	6	28.6%	

Table 4: Baseline characteristics of the included newborns.

Variables		Kangaroo mother care group (N = 25)		Control group (N = 25)		P-value
		Mean	SD	Mean	SD	
Age (days)		13.6	5.7	11.9	4.6	0.22
Variables		N	%	N	%	P-value
Sex of neonates	male	14	56.0%	12	48.0%	0.571
	female	11	44.0%	13	52.0%	
Neonate weight	<1500	23	92.0%	11	44.0%	<0.001*
	1500<2000	2	8.0%	12	48.0%	
	2000<2500	0	0.0%	2	8.0%	

Table 5: Birthweight change at discharge:

Variable	Kangaroo mother care group (number = 25)	
	Mean	Standard deviation
Birth weight at admission	1094.8	270.6*
Birth weight at discharge	1178.8	239.6*
Change	84	77.7

Table 6: comparison of the attachment scores between both groups

Variable	Kangaroo mother care group (N = 25)		Control group (N = 25)		P-value
	Mean	SD	Mean	SD	
Attachment pre score	92.2	19.9	89.8	18.93	0.653
Attachment post score	107.4	0.5	91.16	1.4	<0.001*
P-value	<0.001*		0.711		
Change	15.2	20	1.4	18.6	< 0.001

Table 7: Regression analysis for the factors that can predict improvement in attachment scores:

Predictor	Univariate regression				Multivariate regression			
	Estimate	95% Confidence Interval		p	Estimate	95% Confidence Interval		p
		Lower	Upper			Lower	Upper	
Study group:								
Control group – Kangaroo mother care group	-13.8	-24.79	-2.81	0.015	-8.28	-21.39	4.84	0.209
Monthly income:								
Satisfied to some extent – Satisfied	3.42	-12.01	18.9	0.658	-	-	-	-
Unsatisfied – Satisfied	15.44	-1.38	32.3	0.071	-	-	-	-
Level of education:								
Only read – Can't read and write	17.38	-3.58	38.3	0.102	3.63	-16.8	24.05	0.721
Read and write – Can't read and write	-6.99	-25.55	11.6	0.452	-12.33	-30.05	5.4	0.167
Primary school – Can't read and write	1.31	-15.93	18.6	0.879	-6.01	-22.63	10.6	0.468
Secondary – Can't read and write	6.11	-15.94	28.2	0.579	3.84	-16.13	23.81	0.699
Institute – Can't read and write	52.71	12.44	93	0.012	39.44	1.48	77.4	0.042
College and above – Can't read and write	-6.12	-27.08	14.8	0.559	-4.72	-23.65	14.21	0.616
Occupation:								
Worked – Housewife	-7.18	-28.89	14.5	0.509	-	-	-	-
Student–Housewife	4.82	-25.24	34.9	0.749	-	-	-	-
Residence:								
Urban-Rural	2.42	-9.27	14.1	0.679	-	-	-	-

(Gravida) Number of pregnancies:								
Multigravida – Primigravida	7.85	-4.13	19.8	0.194	-	-	-	-
Type of delivery:								
Cesarean – Normal	3.11	-10.2	16.4	0.641	-	-	-	-
Feeding type:								
Bottle Feeding – Breast Feeding	-23.6	-35.8	-11.37	<0.001	-16.53	-32	-1.06	0.037
Mix feeding – Breast Feeding	-15.4	-28.5	-2.33	0.022	-10.31	-24.22	3.6	0.142
Neonate weight:								
1500 - <2000 – <1500	-5.42	-18.42	7.59	0.406	-	-	-	-
2000 - <2500 – <1500	-18.56	-48.35	11.23	0.216	-	-	-	-
Neonates Gender::								
Female – Male	12.4	1.26	23.5	0.03	8.93	-1.34	19.2	0.086
Neonatal age in days	0.327	-0.806	1.46	0.564	-	-	-	-

Conclusion:

KMC improves the newborn-maternal attachment scores compared to the conventional care. Additionally, it improved the breastfeeding and weight gain of the preterm newborns

The results of the present study showed that Kangaroo Mother Care can be used to improve the maternal attachments in mothers with premature newborns. Additionally, it improves the breastfeeding. In addition, it positively affects the weight gain of preterm newborns.

References:

1. Badiie, Z., Faramarzi, S. & MiriZadeh, T. The effect of kangaroo mother care on mental health of mothers with low birth weight newborns. *Adv Biomed Res* **3**, 214 (2014).
2. Parsa, P., Karimi, S., Basiri, B. & Roshanaei, G. The effect of kangaroo mother care on physiological parameters of premature newborns in Hamadan City, Iran. *Pan Afr Med J* **30**, 89 (2018).
3. Zhu, Z., Wang, X., Chen, W., Pei, S., Wang, Q., Guan, H., *et al.* The efficacy of Kangaroo-Mother care to the clinical outcomes of LBW and premature newborns in the first 28 days: A meta-analysis of randomized clinical trials. *Front Pediatr* **11**, 1067183 (2023).
4. Papadopoulou, S.K., Pavlidou, E., Dakanalis, A., Antasouras, G., Vorvolakos, T., Mentzelou, M., *et al.* Postpartum Depression Is Associated with Maternal Sociodemographic and Anthropometric Characteristics, Perinatal Outcomes, Breastfeeding Practices, and Mediterranean Diet Adherence. *Nutrients* **15**(2023).
5. Li, H. Maternal-Newborn Attachment and its Relationships with Postpartum Depression, Anxiety, Affective Instability, Stress, and Social Support in a Canadian Community Sample. *Psychiatr Q* **94**, 9-22 (2023).
6. Bera, A., Ghosh, J., Singh, A.K., Hazra, A., Som, T. & Munian, D. Effect of kangaroo mother care on vital physiological parameters of the low birth weight newborn. *Indian J Community Med* **39**, 245-249 (2014).
7. Pados, B.F. & Hess, F. Systematic Review of the Effects of Skin-to-Skin Care on Short-Term Physiologic Stress Outcomes in Preterm Newborns in the Neonatal

- Intensive Care Unit. *Adv Neonatal Care* **20**, 48-58 (2020).
8. Wang, Y., Zhao, T., Zhang, Y., Li, S. & Cong, X. Positive Effects of Kangaroo Mother Care on Long-Term Breastfeeding Rates, Growth, and Neurodevelopment in Preterm Newborns. *Breastfeed Med* **16**, 282-291 (2021).
 9. Vargas Vásquez, A.N. & Pardo Torres, M.P. Validez y consistencia interna del instrumento Vínculo entre padres e hijos neonatos %J Enfermería Global. **19**, 255-285 (2020).
 10. Cho, E.S., Kim, S.J., Kwon, M.S., Cho, H., Kim, E.H., Jun, E.M., *et al.* The Effects of Kangaroo Care in the Neonatal Intensive Care Unit on the Physiological Functions of Preterm Newborns, Maternal-Newborn Attachment, and Maternal Stress. *J Pediatr Nurs* **31**, 430-438 (2016).
 11. Mohamed, H., El-Nagger, N. & Zaki, S. Effect of Kangaroo Mother Care on Premature Newborns' Physiological, Behavioral and Psychosocial Outcomes in Ain Shams Maternity and Gynecological Hospital, Cairo, Egypt. *Life Science Journal* **10**(2013).
 12. Campbell-Yeo, M., Johnston, C., Benoit, B., Latimer, M., Vincer, M., Walker, C.D., *et al.* Trial of repeated analgesia with Kangaroo Mother Care (TRAKC Trial). *BMC Pediatr* **13**, 182 (2013).
 13. Mehrpisheh, S., Doorandish, Z., Farhadi, R., Ahmadi, M., Moafi, M. & Elyasi, F. The Effectiveness of Kangaroo Mother Care (KMC) on attachment of mothers with premature newborns. *Eur J Obstet Gynecol Reprod Biol X* **15**, 100149 (2022).
 14. Gathwala, G., Singh, B. & Balhara, B. KMC facilitates mother baby attachment in low birth weight newborns. *Indian J Pediatr* **75**, 43-47 (2008).
 15. Tessier, R., Cristo, M., Velez, S., Giron, M., de Calume, Z.F., Ruiz-Palaez, J.G., *et al.* Kangaroo mother care and the bonding hypothesis. *Pediatrics* **102**, e17 (1998).
 16. Kennell, J. & McGrath, S. Starting the process of mother-newborn bonding. *Acta Paediatr* **94**, 775-777 (2005).
 17. Cristóbal Cañadas, D., Parrón Carreño, T., Sánchez Borja, C. & Bonillo Perales, A. Benefits of Kangaroo Mother Care on the Physiological Stress Parameters of Preterm Newborns and Mothers in Neonatal Intensive Care. *Int J Environ Res Public Health* **19**(2022).