



Effects of Kangaroo Mother Care: A Quasi-Experimental Design

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Abstract

Purpose: This study aimed to implement safe and suitable kangaroo mother care with healthy mothers and newborns immediately after childbirth. In addition, it aimed to assess its effects on maternal attachment, maternal role confidence, and maternal role satisfaction. **Research design, data and methodology:** A quasi-experimental design was used with pre and posttests. A total of 58 participants were selected by convenience sampling through public notifications at a women's hospital. The control group performed routine care without providing kangaroo contact, and a posttest was performed four weeks after the pretest. The experimental group comprised healthy mothers who had given birth by cesarean section. They performed kangaroo mother care twice a day (60 min each) for four weeks for their newborns after the protocol was validated by an expert. **Results:** The results showed significantly higher maternal attachment, maternal role confidence, and maternal role satisfaction in mothers who participated in kangaroo mother care than those who did not. Our findings suggested that kangaroo mother care has a positive effect on the enhancement of maternal attachment and facilitation of maternal role confidence and satisfaction. **Conclusions:** Thus, the expansion and implementation of kangaroo mother care are necessary to promote healthier mother-child relationships.

Keywords : Kangaroo Mother Care, Maternal Attachment, Maternal Role Confidence, Maternal Role Satisfaction, Childbirth

JEL Classification Codes : I12, I19, I20, I25

1. Introduction

1.1. Necessities of Research

In May 2021, the World Health Organization (WHO) published a report that promoted the practice of kangaroo mother care (KMC), stating that up to 150,000 lives could be saved by starting KMC immediately after birth (WHO, 2021). Not receiving KMC increases the risk of mortality among preterm and low-birth-weight infants, which is 65 times higher than the risk of mortality associated with COVID-19 infection (WHO, 2021). Performing KMC reportedly reduced the mortality rate among newborns by

36%; reduced neonatal sepsis, hypoglycemia, and hospital readmission and had a significant effect on neonatal care, including increased exclusive breastfeeding (Boundy et al., 2016).

KMC involves skin-to-skin contact between a mother and her baby. The term 'kangaroo care' was first given to the care provided to low birth weight infants by their mothers in Bogota, Colombia, South America, in 1983 (Whitelaw et al., 1985). KMC can be performed easily between a mother and her newborn without any specialized medical skill or apparatus. It effectively regulates body temperature through skin-to-skin contact between the mother and newborn, thereby promoting breastfeeding and enhancing attachment (Lima et al., 2000). It is the most

optimized and individualized intervention method that can help in understanding the behavior of a newborn through the provision of gentle and affectionate physical contact by the mother (Dodd, 2005).

Since the 2000s, several studies conducted in Korea have reported positive effects of KMC; however, very few hospitals implement it (Bang 2011). More studies on the benefits of KMC for newborns and mothers are necessary to promote its implementation. In a systematic review study (Park, 2020), it was found that KMC reduced anxiety in mothers (Moon & Koo, 2000; Lee & Shin, 2007; Lim et al., 2016) and had a positive effect on maternal attachment (Lee & Shin, 2007; Lim et al., 2016), maternal role confidence (Moon & Koo, 2000; Lee & Shin, 2007; Lim et al., 2016; Shin and Park, 2013), and maternal role satisfaction (Moon & Koo, 2000). These studies reported the effects of motherhood on premature infants.

KMC has been recommended for all newborns as it helps to form maternal attachment by actively providing stability, love, and sensory stimulation to newborns (WHO, 2021). It is necessary to continue to study the effects of providing KMC to not only premature infants or infants in neonatal intensive care units (NICUs), but also to healthy newborns. However, most studies have focused on premature infants or infants in NICUs, whereas studies on healthy newborns are still lacking.

Maternal attachment involves stable interactions between the mother and child to form sustainable, affectionate, and emotional bonds, and solidarity throughout life (Pennestri et al., 2015). It facilitates the neuronal development that occurs actively during the first two years of a child's life, and from a developmental aspect, it is important during the neonatal stage (de Cock et al., 2017). Poor maternal attachment within the first three months is highly correlated with an increased risk of future developmental problems (Eisenberg et al., 2001) and can influence child abuse depending on its level (Oldbury & Adams, 2015). Mothers with a high risk of child abuse have diminished sensitivity for recognizing the needs and signals of newborns and may also exhibit hostility toward newborns and have low emotional empathy. Such poor attachment relationships can have a negative influence on child growth

and increase the risk of child abuse (Kluczniok et al., 2016). Therefore, measures for implementing programs that can increase maternal attachment according to positive role performance by mothers are needed.

Maternal role confidence is a role attachment index that the mother feels as she performs her role as a mother, and it refers to the mother's self-perceived self-efficacy with respect to developmental task achievement (Moon & Koo, 2000). Maternal role confidence is not only an important factor in maternal role adaptation, but also in forming maternal role satisfaction (Lee, 1991). Accordingly, the purpose of this study was to analyze the effects of KMC among healthy newborns and their mothers, to establish a basis for future clinical applications.

1.2. Objectives of Research

We aimed to apply KMC, safely and suitably, in situations faced by mothers immediately after childbirth, and to assess its effects on maternal attachment, maternal role confidence, and maternal role satisfaction.

1.3. Study Hypotheses

- Hypothesis 1: Mothers who participate in KMC have a higher maternal attachment score than their counterparts.
- Hypothesis 2: Mothers who participate in KMC have a higher maternal role confidence score than their counterparts.
- Hypothesis 3: Mothers who participate in KMC have a higher maternal role satisfaction than their counterparts.

2. Study Methods

2.1. Research Design

This quasi-experimental study used a non-equivalent control group pretest posttest design <Table 1>.

Table 1: Research design

| | Pretest | Routine Care | Posttest | Pretest | Intervention | Posttest |
|---------------------------|---------|--------------|----------|---------|--------------|----------|
| Experimental group | | | | E1 | T2 | E2 |
| Control group | C1 | R1 | C2 | | | |

Note: E1, C1: Characteristics, maternal attachment, maternal role confidence, maternal role satisfaction; R1: routine care without kangaroo contact; T1: kangaroo mother care twice a day (60 min each) for four weeks after childbirth; E2, C2: maternal attachment, maternal role confidence, maternal role satisfaction

2.2. Participants and Sampling Method

Healthy mothers who gave birth to healthy infants through professional obstetrics/gynecology (OB/GYN) care were conveniently sampled from I Women's Hospital, S City, South Korea. The inclusion criteria were 1) mothers who gave birth to a healthy infant with no congenital deformity, complications, or need for artificial ventilation; 2) mothers who had not been diagnosed with any physical/mental disorder or taking any related medication; and 3) mothers who understood the purpose of this study and voluntarily consented to participate.

The sample size was based on a study by Bae (2016) that reported a total effect size of 0.54–0.91 and an approximate effect size of 0.80. When the G-power 3.1.2 program was used to calculate the sample size using a two-sided independent t-test with an effect size of .80, statistical power of 80%, and significance level of .05, the minimum sample size was determined to be 26 per group. Based on the dropout rate in a previous study, 30 participants were assigned to each group.

In the control group, two participants failed to participate in the posttest owing to conflicting schedules. Accordingly, 28 participants were included in the final analysis. A total of 30 out of 38 volunteers in the experimental group were selected and included in the program. Therefore, the total study population consisted of 58 participants, which satisfied the minimum sample size requirement (Figure 1).

2.3. Tools

2.3.1. Maternal Attachment

Maternal attachment was measured using a modified tool adapted into Korean (Han, 2001) from the original Maternal Attachment Inventory (Müller, 1994). The tool consisted of 26 items, each graded on a 4-point Likert scale. The Cronbach's α was .89 in the scale modification study (Han, 2001) and .93 in this study.

2.3.2. Maternal Role Confidence

Maternal role confidence was measured using a modified tool adapted into Korean (Lee, 1991), from the original tool [21]. The tool consisted of 14 items, each graded on a 4-point Likert scale. The Cronbach's α was .62–.82 at the time of development, .94 in the scale modification study (Lee, 1991), and .83 in this study.

2.3.3. Maternal Attachment Satisfaction

Maternal role satisfaction was measured using a modified tool adapted into Korean (Lee, 1991) from the original tool (Lederman et al., 1981). The tool consisted of 13 items, each graded on a 4-point Likert scale. The Cronbach's α was .62–.82 at the time of development,

and .95 in the scale modification study (Lee, 1991), and .89 in this study.

2.4. Procedures

2.4.1. KMC

The KMC program was implemented by helping mothers build positive attitudes toward childcare and increase maternal role confidence and maternal role satisfaction through mother-child attachment.

Skin-to-skin contact was applied between mothers and children based on the KMC protocol used in previous studies (Bae, 2016; Bell & McGrath, 1996; Wilson & Hockenberry, 2011). Preparations were supervised by a trained nurse. The mother would wash her hands and chest, change into a provided patient gown, sit comfortably in a chair, uncover the upper part of the gown, and warm the chest area by rubbing, after which the baby, wearing only a diaper and cap, was held upright on the mother's bare chest while maintaining skin-to-skin contact. The mother could sit down by bending her knees while holding the baby's bottom and back with one hand, and holding the baby's head and neck with the other. To keep the baby warm, the mother could cover the baby's back with the gown she was wearing, and she could also make eye contact with the baby or shift the baby from one hand to the other. However, the mother had to be careful not to move the baby too much or talk too loudly to ensure that the baby was not irritated. The quality of contact may vary depending on the duration of contact, area of contact, intensity of action, frequency of action, and feelings. Considering that the sense of unity with the person in contact decreases with shorter durations of contact, KMC was performed twice a day (60 min each) for four weeks (Bae, 2016; Lee & Sang, 2008).

2.4.2. Expert Validation and Pilot Study

The content validity index (CVI) was applied to determine and quantify the validity of the KMC protocol (Waltz & Bausell, 1981). The protocol, method, place, time, and frequency of KMC were assessed using a tool based on a 4-point Likert scale; results showed a total score of ≥ 3 points. Validity (Lynn, 1986) was tested and revisions were made based on recommendations from one pediatrician, two head nurses with more than 20 years of mother-child nursing experience, and two mother-child nursing professors. Subsequently, a pilot study was conducted on five mothers to test the feasibility of kangaroo care.

2.4.3. Researcher Preparation and Research Assistant Training

To train the research assistants, the NICU team leader and a nurse with 20 years of clinical experience reviewed the purpose, methods, and procedures of the study and

refined the KMC protocol. Five nurses who worked in the neonatal unit and could faithfully perform mother-child nursing were selected as research assistants. The assistants were trained according to the KMC protocol, and their understanding was determined after a discussion. After training, the research assistants practiced the KMC method five times per week. Based on observations made during this practice, the protocol was further revised to minimize possible errors.

2.4.4. Pretest

To prevent the spillover effect between the control and experimental groups, data collection from the control group was completed before collecting data from the experimental group. The pretest was administered to investigate their characteristics, maternal attachment, maternal role confidence, and maternal role satisfaction. A questionnaire survey (10 min long) was administered.

2.4.5. Experimental Intervention

The experimental group performed KMC twice a day (60 min each) for four weeks after childbirth. The control group received routine care without kangaroo contact. The control group was investigated from October 1 to 28, 2017, and the experimental group performed the intervention for four weeks from October 29, after investigation of the control group was completed.

2.4.6. Posttest

Maternal attachment, maternal role confidence, and maternal role satisfaction in the experimental and control groups were investigated four weeks later.

2.5. Ethical Considerations

This study was conducted after approval from the Institutional Review Board (IRB) of our university [Details blinded for peer review]. The purpose and procedures of this study were sufficiently explained to the hospital administrator, and the study was conducted after consultation and consent. They were informed they had the freedom to withdraw their consent to participate at any time and would not suffer any negative consequences. Upon completion of the posttest, a small token of appreciation was given to all the participants.

2.6. Data Analysis

The data were analyzed using IBM SPSS/WIN 24.0 (SPSS Inc., IL, USA). The homogeneity of the dependent variables and general characteristics of the experimental and control groups were analyzed using the independent t-test, χ^2 -test, or Fisher’s exact test. The normality of variables was tested using the Kolmogorov–Smirnov test, whereas the interventional effect was analyzed using ANOVA. Although homogeneity was secured in the two groups in advance, ANCOVA was used to compare differences in the dependent variable after kangaroo care was applied to minimize the test effect and statistically control the effect of the subject’s exogenous variables on the dependent variable (Lee et al., 2009). The pre-dependent variable scores were controlled and post-hoc scores were compared, and all statistical significance tests were two-sided at $<.05$. The effect size was presented as partial η^2 .

Table 2: Homogeneity Tests of the General Characteristics & Dependent Variable of the Two Groups (N = 58)

| Division | Categories | Exp. (n = 30) | Cont. (n = 28) | χ^2 or t | p | |
|------------------------------------|-------------------|---------------------------------|---------------------|------------------|-------|------|
| | | n (%) or M \pm SD | n (%) or M \pm SD | | | |
| Characteristics | Age* | 25-30 | 6(20.0) | 3(10.7) | -1.83 | .073 |
| | | 31-35 | 17(56.7) | 13(46.4) | | |
| | | 36-40 | 6(20.0) | 11(39.3) | | |
| | | 40 Over | 1(3.3) | 1(3.6) | | |
| | | M \pm SD | 32.93 \pm 3.45 | 34.60 \pm 3.48 | | |
| | Education* | High School | 0(0.0) | 2(7.1) | 1.78 | .081 |
| | | University | 29(96.7) | 26(92.9) | | |
| | | Graduate degree | 1(3.3) | 0(0.0) | | |
| | Religion | Have | 15(50.0) | 16(57.1) | .25 | .804 |
| | | None | 15(50.0) | 12(42.9) | | |
| | Career | Housewife | 15(50.0) | 12(42.9) | -.54 | .594 |
| | | Part time | 2(6.7) | 2(7.1) | | |
| | | Full-time job | 13(43.3) | 14(50.0) | | |
| | Family type | Nuclear family | 28(93.4) | 26(92.9) | -.07 | .947 |
| | | With parents of a married woman | 1(3.3) | 1(3.6) | | |
| | | With parents-in-law | 1(3.3) | 1(3.6) | | |
| | Planned pregnancy | Yes | 21(70.0) | 17(60.7) | -.73 | .466 |
| No | | 9(30.0) | 11(39.3) | | | |
| Someone in the family to help take | Husband | 17(56.7) | 14(50.0) | .38 | .708 | |
| | Mother-in-law | 2(6.7) | 3(10.7) | | | |

| | | | | | | |
|----------|----------------------------|------------------------|----------|----------|-------|------|
| | care of the newborn | Married woman's mother | 10(36.6) | 11(39.3) | .36 | .723 |
| | | Other | 0(0.0) | 0(0.0) | | |
| | Birth order of newborns | First | 19(63.3) | 19(67.9) | | |
| | | Second or more | 11(36.7) | 9(32.1) | | |
| Variable | Maternal attachment | | 3.79±.45 | 3.74±.66 | 0.36 | .714 |
| | Maternal role confidence | | 2.61±.36 | 2.63±.48 | -0.22 | .825 |
| | Maternal role satisfaction | | 3.17±.54 | 3.39±.44 | -1.66 | .102 |

Note: Cont. = Control group; Exp. = Experimental group; M = Mean; SD = Standard deviation

*Fisher's exact test

3. Results

3.1. Homogeneity Testing of General Participant Characteristics

Homogeneity testing of the general participant characteristics showed no significant differences, and therefore, the two groups were homogeneous <Table 2>.

3.2. Pretest on Homogeneity of Dependent Variables

The pretest showed no significant differences between the experimental and control groups with respect to maternal attachment ($t = 0.36, p = .714$), maternal role confidence ($t = -.22, p = .826$), and maternal role satisfaction ($t = -1.66, p = .102$) <Table 2>.

3.3. KMC-Related Hypothesis Testing

3.3.1. Hypothesis 1

Maternal attachment score improved by 0.70 ± 0.04 points (from 3.79 ± 0.45 to 4.42 ± 0.47) in the experimental group and by 0.44 ± 0.33 (from 3.74 ± 0.66 to 4.21 ± 0.74) in the control group. The differences between the experimental and control groups from pretest to posttest were statistically significant ($F = 68.08, p < .001, \text{partial } \eta^2 = .553$). Therefore, Hypothesis 1 was supported <Table 3>.

3.3.2. Hypothesis 2

Maternal role confidence score improved by 0.51 ± 0.51 points (from 2.61 ± 0.36 to 2.90 ± 0.46) in the experimental group and by 0.14 ± 0.38 (from 2.63 ± 0.48 to 2.80 ± 0.45) in the control group. The differences between the experimental and control groups from pretest to posttest were statistically significant ($F = 17.70, p < .001, \text{partial } \eta^2 = .250$). Therefore, Hypothesis 2 was supported <Table 3>.

3.3.3. Hypothesis 3

Table 3: Effects of KMC on the Variables between the Two Groups (N = 58)

| Variables | Groups | Pretest | Pretest | F* | p | Partial η^2 |
|----------------------------|--------|-----------|-----------|-------|-------|------------------|
| | | M±SD | M±SD | | | |
| Maternal attachment | Exp. | 3.79±0.45 | 4.42±0.47 | 68.08 | <.001 | .553 |
| | Cont. | 3.74±0.66 | 4.21±0.74 | | | |
| Maternal role confidence | Exp. | 2.61±0.36 | 2.90±0.46 | 17.70 | <.001 | .250 |
| | Cont. | 2.63±0.48 | 2.80±0.45 | | | |
| Maternal role satisfaction | Exp. | 3.17±0.54 | 3.47±0.42 | 7.93 | .007 | .130 |
| | Cont. | 3.39±0.44 | 3.42±0.45 | | | |

Note: Exp. = Experimental group (n = 30); Cont. = Control group (n = 28)

*Results of ANCOVA controlling the values at pretest as a covariate

Maternal role satisfaction improved by 0.40 ± 0.73 points (from 3.17 ± 0.54 to 3.47 ± 0.42 points) in the experimental group and by 0.01 ± 0.26 points (from 3.39 ± 0.44 to 3.42 ± 0.45 points) in the control group. The differences between the experimental and control groups from pretest to posttest were statistically significant ($F = 26.26, p = .007, \text{partial } \eta^2 = .130$). Therefore, Hypothesis 3 was supported <Table 3>.

4. Discussion

The purpose of this study was to apply KMC safely and suitably in situations faced by mothers immediately after childbirth and to assess its effects on maternal attachment, maternal role confidence, and maternal role satisfaction.

First, mothers who participated in KMC showed a significant improvement in their maternal attachment scores compared to their counterparts. This is consistent with the increased maternal attachment reported in studies on

premature infants (Lim et al., 2015; Jang, 2009). KMC intervention has been reported to effectively reduce anxiety in parents of premature infants and increase mother–child attachment (Park, 2020).

In a study on premature infants in the NICU (Kim & Cho, 2017), fathers performed kangaroo care. Kangaroo care by fathers was expected to be challenging owing to visitation restrictions in the NICU; however, the findings revealed active participation by fathers and an increase in paternal attachment. In modern societies, both mothers and fathers partake in childcare, which suggests that studies related to the enhancement of paternal attachment must also be conducted, and KMC training for both parents is necessary.

A study has mentioned the importance of forming parental attachment at birth and the application of KMC as an independent nursing intervention to promote the growth of premature infants (Jang, 2009). However, as most previous studies applied KMC intervention to premature infants, direct comparison with the present study is difficult. Nonetheless, applying KMC intervention to healthy newborns could also have a positive effect on the formation of maternal attachment, which can increase interaction with the newborn, as well as increase the parents' love, warmth, and care towards their child.

Second, mothers who participated in KMC showed a significant improvement in their maternal role confidence scores compared to their counterparts. This is consistent with previous studies on premature infants (Moon & Koo, 2000; Shin & Park 2013). In addition to enhancing maternal role confidence, KMC also helps reduce anxiety by promoting contact and interactions between mother and child during hospital stay, which enables mothers to have more confidence in childcare (Moon & Koo, 2000). A study (Jeong & Kim, 2016) reported that most nurses recognized that KMC can enhance parental confidence, help physical stability, and promote effective breastfeeding.

Third, mothers who participated in KMC showed a significant improvement in their maternal role satisfaction scores compared to their counterparts. This is consistent with a previous study on premature infants (Moon & Koo, 2000); thus, it can be concluded that maternal role confidence leads to satisfaction. Therefore, a broader implementation of KMC is needed to promote the development of maternal role confidence and satisfaction in mothers after childbirth.

5. Conclusion

This quasi-experimental study used a non-equivalent control group pre-test post-test design for the implementation of KMC among healthy mothers and newborns immediately after birth, to investigate its effects

on maternal attachment, maternal role confidence, and maternal role satisfaction. The findings indicated that the experimental group, which practiced KMC, showed significant improvements in maternal attachment, maternal role confidence, and maternal role satisfaction. The findings provide basic data for the clinical application of KMC by identifying its efficacy and confirming that KMC has a positive effect on enhancing maternal attachment and facilitating maternal role confidence and satisfaction.

The following recommendations are made based on the findings of this study. First, it is necessary to conduct a longitudinal study to identify the sustained effects and maintenance of the program. Second, a qualitative research method is recommended for a more in-depth analysis of the participants' perceptions or subjective values to identify factors that can enhance maternal attachment and maternal role confidence in mothers who give birth normally. Third, replication studies with larger sample sizes and expanded study populations are recommended to verify the validity of the findings in this study.

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