

The Effects of Kangaroo Care on Maternal Self-esteem and Premature Infants' Physiological Stability

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Purpose: This paper identified the effects of kangaroo care (KC) on maternal self-esteem and the growth and physiological stability of premature infants hospitalized in the neonatal intensive care unit. **Methods:** The experiment was conducted with an experimental group of 17 infants, and a control group of 17 infants selected by convenience sampling. KC was given to the infants one time a day for 30 minutes after feeding for two weeks. Their weight was measured every morning, and their physiological stability was measured in terms of their body temperature, respiratory rate, heart rate, oxygen saturation, and stability of the cardio-respiratory system in premature infants (SCRIP) score, as physiological responses at every 10 minutes during the intervention. Maternal self-esteem was assessed by a maternal self-report inventory. **Results:** The experimental group showed significant increase in the self-esteem of mothers. Also, KC was effective on physiological stabilization of preterm infants. **Conclusion:** This study suggests that KC can be provided in clinical settings more widely in Korea as one of the nursing interventions aimed at promoting maternal self-esteem as well as infants' physiological stabilization.

Key Words: Kangaroo care, Premature infants, Physiological response, Maternal self-esteem, Nursing

INTRODUCTION

The rate of low birth weight has increased in Korea, so that developmental care for premature infants has become a great concern in recent years. KC is a relatively new approach to caring for premature infants, but it offers a wide range of benefits that apply to the infants and their parents (Hall & Kristen, 2008). "Kangaroo care (KC)" began in Bogota, Colombia as an intervention to maintain infant body temperature when incubators were not sufficient in the late 1970s. This method of holding infants skin to skin spread worldwide because of the reported benefits of this practice. Kangaroo care of premature infants dressed only in diapers against their mothers' breast in the technology-intensive nursery environment has been shown to promote thermal regula-

tion, decrease the risk of infant mortality and severe sepsis, build maternal confidence, and improve breast feeding success and mother-infant attachment (Charpak et al., 2005; Conde-Agudelo, Belizán, & Diaz-Rosello, 2011).

Early research examining the effect of kangaroo holding on a small sample (n=12) of premature infants in the United States noted that infants maintained physiologic stability, measured by thermoregulation and cardiovascular status, during and after kangaroo holding (Ludington-Hoe, Hadeed, & Anderson, 1991). A more recent study which compared the physiologic effects on preterm infants (n=24) of a 3-hour continuous kangaroo hold versus standard care reported comparable physiologic stability between pre- and post-interventions (Ludington-Hoe et al., 2004). In her review of KC researches, Smith (2007) reported the positive effect

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of KC on sleep and success in achieving discharge to home. The major goal of neonatal nursing care is to support the physiologic and developmental needs of the premature infant in the NICU that may compromise the infant's well-being. Premature infants' stress responses contribute to the risk of iatrogenic complications that can negatively affect long-term developmental outcomes.

In a survey study of mothers with premature infants (n=209), effective communication between neonatal nurses and mothers was shown to have overwhelming priority in decreasing maternal stress in the NICU environment (Bialoskurski, Cox, & Wiggins, 2002). Lawhon (2002) reported that teaching parents interventions that enhance parental competence such as recognizing infant cues supports parents in their roles as advocates, decreases stress, and facilitates parenting. With this information in mind, kangaroo holding is an exceptionally appropriate intervention to facilitate parenting in the NICU.

Although many kangaroo studies examine the positive physiologic effects on infants as well as maternal confidence and mother-infant interaction, in Korea, a few studies have been performed to determine the effects of kangaroo care on premature infants and their mothers (Jang, 2008; Koo, 2000; Shin, 2007). However, kangaroo care is still unfamiliar to nurses and mothers, and has been provided very rarely. Also, previous Korean studies did not measure KC effect on maternal self esteem and premature's overall physiological stability during KC.

A. AIMS

The aims of this study were to identify the effects of kangaroo care for premature infants hospitalized in the neonatal intensive care unit on maternal self-esteem, premature infants' weight gain, and physiological stability.

METHODS

A. Research design and sampling

Non-equivalent pre-test and post-test repeated design was used to assess the impact of KC on premature infants and their mothers. A minimum of 17 for each group needed for statistically significant results in a study of t-test for two group comparison, where an effect size of 1.0, an α of 0.05, and power of 0.8 were

set in order to use G*Power (Faul et al, 2009). Seventeen mothers who agreed to kangaroo care were assigned to the experimental group, who were each matched with a control group of 17 participant with an infant of the same birth weight, present weight, and corrected age. Inclusion criteria for premature infants were (i) present age of more than 32 weeks; (ii) present weight 1,000-2,000g; (iii) physiologically stable without mechanical ventilation; (iv) no major congenital anomalies or skin problems, (v) on full feeding by oral or gavage and no intake restriction.

B. Ethical considerations

Prior to data collection, permission was obtained from the executive nursing department and NICU ward manager of one university hospital. Also, the researcher interviewed premature infants' mothers and those who agreed to take part in this study were included in either the experimental or control group. The researcher explained to the mothers that participation was voluntary and that they could withdraw from the study at any time.

C. Kangaroo care intervention

During the kangaroo care period, the premature infants were held naked, except for a diaper and hat, against the mother's chest and covered with a cotton blanket. This method of KC was modified for feasibility in NICU setting through literature review on the basis of WHO guidelines (WHO, 2003). Before intervention, researcher provided education to mothers individually about the KC method and infant's safety. The procedures were as follow.

a. Infection control

All the skin of contact including the mother's chest, abdominal area, lower arm and hand had to be completely disinfected by 0.4% chlorohexidine (SNUH, 2008) and a warm sterilized cotton ball to prevent any contagion.

b. Mother's preparation

Mothers wore a wide blouse or shirt that covered the infants' trunk and extremities. Mothers sat in a self-chosen position in a comfortable chair with an adjustable back allowing the mother's sitting position to be between 45 and 60 degrees. During KC, mothers were permitted to saying, singing and whispering some-

thing to her baby.

c. Infant's preparation

The premature infants lay in an upright and prone position. A chair for KC was placed near the beds of infants and a screen was laid down to make a more quiet and independent room, thereby minimizing the movement of infants. When KC was finished, infants were returned their former state (on bassinet or in incubator) for conventional care in NICU.

d. Length and duration of KC

The KC was given to the infants in the experimental group during visiting hours once a day for 30 minutes after feeding for two weeks. The experiment was carried out 12.05 times on average. Premature infants and mothers in both groups were treated in the same manner except for the KC practice.

D. Measures

a. Body weight

Body weight was measured in every morning after bathing, using an infant's body weight scale.

b. Physiological response

Physiological response was measured in terms of the body temperature, heart rate, respiration rate, oxygen saturation, and SCRIP score as marks of physiological stabilization of premature infants. The SCRIP score (Table 1) is a reliable instrument for determining the level of cardiorespiratory stability. It takes into account characteristics in the subnormal range such as periodic breathing, apnea, and deceleration of the heart rate. For every single parameter it has three grades: severe instability (0 points), minor instability (1 point), and perfect stability (2 points).

Body temperature of premature infants was measured by a forehead skin thermometer (Hubdic dotorideluxe FS-100, Korea) to reduce any chance of handling. During kangaroo care practice, the infants were continuously monitored by a cardiorespiratory mon-

itor (Solar 8000i M neonatal monitor, USA) based on transthoracic impedance plethysmography with an attached pulse oximeter (Nellcor Inc., USA). Heart rate, respiratory rate, and oxygen saturation were monitored continuously. Every 1 minute, all data (heart rate, respiration rate, and oxygen saturation) were recorded and sent for EMR (electrical medical recording) automatically. In addition, we recorded pneumograms using a chart recorder for continuous registration of the heart rate, respiratory pattern, and oxygen saturation. Electrodes for cardiorespirography were placed on the back of each infant to prevent superimposition of maternal respiration. The probe of the pulse oximeter was attached to the left or right foot. The locations of the electrodes for cardiorespirography and the pulse oximetry probe were not changed during the kangaroo care period.

c. Maternal self-esteem

Maternal self-esteem was assessed by a maternal self-report inventory developed by Shea & Tronick (1984) and verified by Han and Bang (1999) in Korea. The maternal self-report inventory is a 26-item scale that yields a total score that reflects the mother's self-esteem. A higher score indicates higher self-esteem. In this study, Cronbach's α was .94.

Study procedures

The detailed processes included a pre-test (one time), intervention (once a day, 2 weeks), and a post-test (one time). Every one minute, all data (heart rate, respiration rate, and oxygen saturation) were recorded and sent for EMR (electrical medical recording) automatically. All data were recorded in physiological response data sheet manually every 10 minutes (onset, 10 min, 20 min, 30 min) based on the EMR recording. To obtain unbiased results, the following attempts were made. First, the investigators in this study served as intervention providers but did not serve as evaluators of the program. This was done to avoid any influence on the outcomes. Second, five research assistants whose major was nursing served as evaluators

Table 1. SCRIP: Stability of the Cardiorespiratory System in Premature Infants Score

SCRIP points	Perfect stability (2 points)	Minor instability (1 point)	Severe instability (0 point)
Heart rate	Regular	Deceleration to 80~100	< 80/min or > 220/min
Respiration	Regular	Apnea < 10 and/or periodic breathing	Apnea > 10, Tachypnea > 80/min
Oxygen saturation	Regular > 90%	Any falls to 80~89%	Any falls below 80%

and measured the outcome variables. Lastly, mothers in the experimental group were instructed not to share the interventions that they had received with counterparts in the control group until the study was completed. The duration of the study was from July 2007 to March 2009 (Figure 1).

Statistical analysis

The collected data were statistically processed via SPSS for Windows (PASW) 18.0. Even though the sample size was small, average 12.05 times of data was obtained from each participants because we collected data everytime during two weeks of intervention, data showed within normal distribution. Therefore, parametric statistics were used for analysis. First, the homogeneity between the experimental and control groups were compared using a t test or a χ^2 -test. Second, significant effects of the intervention on the dependent variables (i.e., body weight, vital signs, SCRIP score, maternal self-esteem) were explored using a repeated measure ANOVA test. The mean scores of physiologic measures at the onset and 10 min, 20 min, and 30 min were obtained from all of the scores at each time for each group during experimental periods.

RESULTS

A. Tests for homogeneity

Homogeneity in demographics between the experimental and control groups was tested (Table 2). There were no differences in any of the general characteristics between the two groups.

B. Effect of kangaroo care

a. Maternal self-esteem

In pre-test, there was no difference in maternal self-esteem between the experimental and control groups. But at the end of KC, intervention group showed higher maternal self-esteem score than control group ($t=2.822, p=.008$).

b. Body weight

The results of this study indicated that the experimental group, which received kangaroo care, showed a greater weight after two weeks of intervention compared with the control group, but it was not statistically significant (Table 3).

c. Physiological Stability

There were significant interaction effects of group and time in body temperature ($F=25.860, p<.001$), respiratory rates ($F=19.059, p<.001$), heart rates ($F=5.369, p=.002$), oxygen saturation ($F=5.853, p=.001$), and SCRIP scores ($F=18.897, p<.001$), which showed the effects of kangaroo care on physiological stabilization (Table 4).

DISCUSSION

Considerable research throughout the world on the benefits of KC shows that KC promotes cardio-respiratory stabilization, improves thermo-regulation, increases the rate of infant weight gain, correlates with a high incidence of exclusive breast feeding, shortens hospital stays, functions as analgesia, and reduces maternal stress levels (Feldman et al., 2002). However, there is little data about the effects of KC in South Korea, and

Group	Pretest (At the beginning of KC)	During KC (once a day, 2 weeks)				Posttest (the end of KC)
		Onset	10min	20min	30min	
Experimental group (n=17)	- General characteristics - Body weight - Maternal self-esteem	----- Kangaroo care ----- >				- Body weight - Maternal self-esteem
Control group (n=17)		----- Conventional care ----- >				

Figure 1. The data collection procedure.

Table 2. Homogeneity for General Characteristics of Infants and Mothers

Characteristics	Categories	Experimental group (n=17)	Control group (n=17)	χ^2 or t	p
		n (%) or M±SD	n (%) or M±SD		
Mother's age		32.65±3.24	32.41±3.02	0.255	.802
Mother's education	High school	2 (11.8)	6 (35.3)	8.609	.072
	College	13 (76.5)	9 (52.9)		
	Graduate school	2 (11.8)	2 (11.8)		
Mother's occupation	Yes	9 (52.9)	7 (41.2)	1.633	.201
	No	8 (47.1)	10 (58.8)		
Religion	Yes	7 (41.2)	8 (47.1)	0.486	.486
	No	10 (58.8)	9 (52.9)		
Living region	Seoul	10 (58.8)	5 (29.4)	2.997	.558
	Capital area	6 (35.3)	9 (52.9)		
	Others	1 (5.9)	3 (17.6)		
Type of delivery	Vaginal delivery	3 (17.6)	4 (23.5)	0.195	.659
	Cesarean section	14 (82.4)	13 (76.5)		
Number of delivery	0	13 (76.5)	10 (58.8)	0.697	.706
	1	4 (23.5)	6 (35.3)		
	2	0 (0.0)	1 (5.9)		
Parity	Simple	13 (76.5)	13 (76.5)	0.000	.1000
	Twins & triplets	4 (23.5)	4 (23.5)		
Pregnancy	Natural	11 (64.7)	11 (64.7)	0.878	.349
	Artificial	6 (35.3)	6 (35.3)		
Infant's sex	Male	8 (47.1)	8 (47.1)	0.000	1.000
	Female	9 (52.9)	9 (52.9)		
Infant's birth order	1st	11 (64.7)	9 (52.9)	3.091	.543
	2nd	5 (29.4)	6 (35.3)		
	3rd	1 (5.9)	2 (11.8)		
Infant gestational age (week)		27.50±2.89	29.87±3.25	-2.028	.060
Birth weight (kg)		0.99±0.36	1.18±0.45	-1.214	.243
Corrected age (wks)		35.36±2.30	34.59±1.14	1.240	.233
Current body weight (kg)		1.66±0.21	1.61±0.43	0.418	.682
Apgar score	1 min	3.65±1.87	5.06±1.85	-1.967	.067
	5 min	6.24±1.56	7.00±1.17		
Ventilator care	Yes	10 (58.8)	8 (47.1)	0.486	.486
	No	7 (41.2)	9 (52.9)		
Ventilator care days		16.71±26.45	14.47±18.16	0.357	.726
O2 inhalation	Room air	9 (52.9)	10 (58.8)	4.911	.297
	Nasal prong	7 (41.2)	3 (17.6)		
	N-CPAP	1 (5.9)	4 (23.5)		
Type of feeding	Breast milk	10 (58.8)	8 (47.1)	4.736	.857
	Premature milk	1 (5.9)	5 (29.4)		
	Special formula [†]	3 (17.6)	1 (5.9)		
	Together	3 (17.6)	3 (17.6)		
Route of feeding	Oral	10 (58.8)	9 (52.9)	4.307	.366
	Gavage	2 (11.8)	5 (29.4)		
	Oral+gavage	5 (29.4)	3 (17.6)		

KC=kangaroo care, N-CPAP=nasal continuous positive airway pressure.

[†]Neonate, low phosphorus, HA.

Table 3. Comparisons of Maternal Self-esteem and Body Weight

Variables		Experimental group (n=17)	Control group (n=17)	t	p
		M±SD	M±SD		
Maternal self-esteem	Pre	94,88±8,35	97,82±9,18	-0,977	.336
	Post	97,82±9,18	88,59±9,89	2,822	.008
Body weight (kg)	Pre	1,66±0,21	1,61±0,42	0,488	.630
	Post	2,01±0,17	1,82±0,42	1,681	.107

Table 4. Comparisons of physiological measurements between the experimental and the control group using repeated measured ANOVA

Variables	Time	Experimental group (n=17)	Control group (n=17)	Source	F	p
		M±SD	M±SD			
Body temperature (°C)	Onset	36,34±0,21	36,38±0,16	Group Time Group*time	4,723 57,242 25,860	.037 <.001 <.001
	After 10 min	36,52±0,23	36,42±0,16			
	After 20 min	36,61±0,19	36,45±0,16			
	After 30 min	36,71±0,18	36,45±0,08			
Respiration rate (frequency/min)	Onset	55,38±6,16	49,13±6,56	Group Time Group*time	0,998 16,242 19,059	.325 <.001 <.001
	After 10 min	48,32±4,97	50,07±6,31			
	After 20 min	44,65±7,19	48,61±6,65			
	After 30 min	42,46±6,60	50,28±5,89			
Heart rate (frequency/min)	Onset	167,82±9,46	163,59±6,67	Group Time Group*time	0,000 23,796 5,369	.997 <.001 .002
	After 10 min	160,39±8,33	161,66±9,46			
	After 20 min	159,10±8,14	160,38±9,06			
	After 30 min	158,36±8,68	160,00±10,94			
SpO ₂ (%)	Onset	92,70±3,15	91,53±2,41	Group Time Group*time	18,676 37,934 5,853	<.001 <.001 .001
	After 10 min	96,17±1,84	93,65±1,95			
	After 20 min	96,83±1,76	92,70±2,89			
	After 30 min	97,20±1,60	94,20±1,68			
SCRIP score	Onset	4,61±0,28	4,76±0,31	Group Time Group*time	11,859 75,099 18,897	.002 <.001 <.001
	After 10 min	5,24±0,26	5,12±0,29			
	After 20 min	5,57±0,37	5,00±0,39			
	After 30 min	5,70±0,30	5,19±0,24			

as a result, KC is still very limited in this country despite evidence suggesting that it should be used more often.

A. Effects of KC on the mother

In this study, KC mothers showed higher maternal self-esteem than control group mothers. This supported the results of previous studies that overall scores for mother's sense of competence were better in the KC than in the control group (Conde-Agudelo et al., 2011). In another previous Korean study, the KC group also had significantly higher scores in maternal attachment

than the control group (Jang, 2008).

Preterm infants and mothers are often separated at birth and physical contact is delayed; this may impede the development of the mother-infant relationship. KC allows mothers to have this physical contact with their preterm newborn, and it is shown to improve the mother-infant relationship, improve the parenting process, and make mothers feel more confident (Feldman et al., 2002; Roller, 2005).

In their systematic review, Moore, Anderson, and Bergman (2007) found some evidence of improved maternal affection and maternal attachment behavior with KC. The period of time after step-down from in-

tensive care and before discharge is generally viewed as hampering normal bonding interactions as separation limits touching and caring for the infant. However, KC is of great benefit during this period, allowing parents to play an active role, thus decreasing maternal and infant stress (Swinth, Anderson, & Hadeed, 2003). Parmar et al (2009) reported that mood elevation, better confidence and a feeling of positive contribution toward the care of their low birth weight babies was reported by 96% and 94% mothers respectively. They also reported great benefits of KC on lactation.

Also, Neu and Robinson (2010) reported that KC during the early weeks of an infant's life facilitated coregulation between the mother and infant at 6 months of age. Chiu & Anderson (2009) reported that the effect of early KC remained until 18 months. The findings that effects of KC are not limited to the acute stage make us understand the importance of early mother-infant interaction.

B. Effect of KC on premature infants

Many studies have investigated the effect of KC on the physiology of the infant. Examples of specific endpoints that have been studied are temperature, weight, heart rate, respiratory rate, energy expenditure, and head circumference. Not all study designs were robust, but in most, the variables investigated fell within clinically acceptable ranges or were comparable to a control group of infants who stayed in incubators or open cribs, or were swaddled or wrapped, depending on the study (Charpak et al., 2005).

Uvnäs-Moberg (1987) assumed tactile stimulation triggers the activity of sensory nerves which leads to a release of vagally-regulated gut hormones. Since gut hormones stimulate gastrointestinal motor and secretory activity and the growth of the gastrointestinal tract, and enhance glucose-induced insulin release, they may contribute to the beneficial effects on maturation and growth caused by sensory stimulation. Also, Dodd (2005) reported that attachment promoted nurturing behaviors that supported growth and development. However, he continued that weight gain as a benefit of KC remains in question. In contrast, Jang (2008) and Conde-Agudelo, Belizán, and Diaz-Rosello (2011) reported that the KC group had a higher weight gain, and Ahn, Lee, and Shin (2010) reported greater height and head circumference in the KC group than the control group. Therefore, the effects of KC on a preterm infant's growth and weight

gain are still controversial.

The results of this study indicated that the experimental group of premature babies showed more weight gain compared with the control group, but it was not statistically significant. We could not strictly control extraneous variables such as feeding, intravenous fluids and medical treatment that is inevitable in NICU, so the pure effect of KC on weight gain could not be measured. However, we found that some mothers' milk production increased after starting KC, and some premature infants' sucking power improved after smelling their mother's scent during KC. Future studies are recommended on the effect of KC on a premature infant's transition to oral feeding.

In this study, body temperature, heart rate, respiratory rate, and oxygen saturation were recorded just before KC as a baseline data and during and just after KC. The KC group showed a higher body temperature than the control group after KC. Usually premature infants can save their energy and maintain an optimal body temperature through contact with their mother's warm skin during KC. Ludington-Hoe et al. (2004) conducted a randomized controlled trial (RCT) to investigate the cardiorespiratory and thermal effects of KC on healthy preterm infants, and found that mean cardiorespiratory and temperature outcomes remained within clinically acceptable ranges, and apnea, bradycardia, and periodic breathing were absent during KC. In another RCT, Chwo et al. (2002) found that KC infants had higher mean tympanic temperatures and more quiet sleep than control infants. A systematic review reported that skin-to-skin care is highly effective in preventing hypothermia in preterm infants (Conde-Agudelo et al., 2011).

There was a significant difference in the two groups' respiratory rate, oxygen saturation, and physiological responses according to SCRIP scores, which showed the effects of KC on physiological stabilization. KC seems to be beneficial for the premature infant's respiratory function including the infant's oxygen requirement, because the upright contained position of KC increases the efficiency of the diaphragm and pulmonary function, improving oxygenation by promoting cardiorespiratory stabilization. Oxygen saturation is also improved because of the relationship between KC and motor regulation. Fisher et al. (1998) reported that SCRIP scores did not change significantly during KC. However, in some infants, the stability changed markedly either for the better (in seven infants) or for the worse (in six infants) and the varying response of in-

dividual premature infants to KC was explained by the varied physical position of the infants during KC.

Regarding heart rates, the decrement of heart rate within normal limits during KC was detected. The heart rate in the experimental group may have decreased because the premature infant's useless movements were decreased with warm tactile stimulation and a calm atmosphere, and because some of them fell asleep. Some researchers reported no change in the heart rate during KC (Fisher, 1998) whereas some others reported an increment in the heart rate during KC within normal limits (Föhe, Kropf, & Avenarius, 2000).

Consequently, the majority of studies reported KC intervention appears to have an influence on vital stability and more efficient gas exchange, and the same results were identified in this study.

The results of this study suggest that the practice of KC in the nursing environment might actively promote attachment between the mother and infant as well as acceleration of growth for premature infants as one of the most efficient nursing interventions. However, even though KC proved to be an effective nursing intervention for premature babies, it is not common in Korea. Johnson (2007) identified staffing levels, maternal readiness, and encouragement from the management as factors influencing implementation of KC in a special care nursery.

One of the limitations of this study was small sample size. Also, generalization can be limited because the study was performed in one hospital. Therefore, replication studies need to be performed with more participants in multiple hospitals in Korea.

In summary, this study identified the effects of KC in NICU settings in South Korea on premature infants' physiological stability as well as on maternal self-esteem. Strategies for implementing KC in a Korean clinical setting need to be developed.

CONCLUSION

Unlike other interventions of sensory stimuli provided by medical personnel in the neonatal intensive care unit, KC promotes stability of the physiological state of premature infants and contributes to their development through positive and consistent contact with mothers who take care of their infants. Also, in light of this study, we expect that KC will be offered in more clinical practices as a nursing intervention aimed at promoting the maternal self-esteem of mothers. In particular, nurses in the neonatal intensive care unit

play a key role in encouraging contact between mothers and their infants, so that more mothers can participate in KC. Future study is needed to determine the effect of KC in various clinical settings and to identify the long term effect of KC. Especially when KC perform any setting, nurses should be concerned about prevention of contact infection. And we strongly suggest that this method of KC should be expanded to more hospitals and become routine care for premature infants in South Korea. All new mothers, if they are able and whether or not they ask to do KC, should be encouraged to experience KC and assured that they will take additional supports from nurses.

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