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ORIGINAL ARTICLE

모성역할자신감, 고위험신생아의 신장 및 수유량과 모아접촉간의 관계: 마음터치

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Relationship between Maternal Touch, Maternal Self-Confidence, Infant Length, and Feeding Volume in High-Risk Infants: Touch on the Mind

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Key messages

고위험 신생아 어머니들은 낮은 모성역할자신감을 보인다. 피부접촉 감각자극을 통해 어머니/영아는 상호작용하며 편안함을 경험한다. 본 연구는 산후초기 모아 접촉이 영아성장 및 모성역할자신감과의 연관성 조사를 목적으로, NICU의 어머니-영아 36쌍에 대하여 접촉 신체부위를 관찰하고 의무기록과 설문지를 통해 측정하였다. 수집자료는 Mann-Whitney U test를 통해 검증하였다. 산후초기에 모성역할자신감은 점차 감소하였으나, 아기의 얼굴/머리 또는 팔다리를 많이 접촉한 엄마들의 경우 감소폭이 적었다. 아동의 경우, 수유량과 키가 증가하였으며 엄마가 몸통 또는 팔다리를 많이 접촉한 아동은 그 증가량이 더 컸다. 본 연구는 조기 모성 접촉 중요성을 강조하며 적절한 신체 부위에 접촉을 제공할 것을 제안한다.

중심단어: 피부접촉, 고위험신생아, 신생아성장, 모성역할자신감

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Abstract

Background: Childbirth is a physical and emotional experience. In particular, mothers of high-risk infants often exhibit low maternal self-confidence. Through interactions in the form of touch, maternal sensory stimulation provides comfort for both mother and baby. This study aims to investigate the association between maternal touch in the early postpartum period and the growth of infants as well as maternal self-confidence.

Methods: Thirty-six mother-infant dyads in a level III-IV Neonatal Intensive Care Unit (NICU) were analyzed. Maternal touch on various body parts (extremities, face/head, and trunk) was observed, and infant length and feeding volume were assessed by direct measurement of the medical records. Maternal self-confidence was assessed using a questionnaire. Along with descriptive statistics, we conducted correlation and Mann-Whitney U tests.

Results: Although maternal self-confidence decreased over time, that of mothers with a high level of contact with the infant's face/head or extremities decreased significantly less than that of mothers in the low-contact group. For the baby, the feeding volume of infants with a high degree of maternal contact on their extremities or trunk increased significantly compared with that of the low-contact group.

Conclusions: Mothers' self-confidence may not improve as the infant grows, but can be strengthened by enhanced touch on the infant's face/head. Touching the infant's trunk is related to infant feeding. The research findings emphasize the importance of early maternal touch in the NICU environment and recommend the provision of maternal touch to appropriate body parts to achieve the desired objectives.

Key Words: Touch, Infant, Premature, Growth, Self-confidence

Introduction

Every family looks forward to the birth of a healthy baby. However, a report on high-risk infants (HRIs) by the World Health Organization (WHO) revealed that approximately 15 million babies are born prematurely, before 37 weeks of gestation, and that preterm birth rates are increasing globally [1]. Moreover, the number of first-time mothers aged over 35 years who have a higher risk for

pregnancy complications is constantly growing. During the postpartum period, mothers experience difficulties and stress in adapting to their new roles associated with raising newborns, along with various physical changes caused by childbirth [2]. In the case of HRIs, such difficulties can be further aggravated by the prospect of taking on the role of guardianship for a sick or premature baby. HRIs are admitted to the neonatal intensive care unit (NICU) immediately after birth. Environmental factors in the NICU, such as noise, light, and various unfavorable stimuli, can be stressors for both mothers and infants [3]. Furthermore, the limited opportunity to provide care during hospitalization in the NICU can make it difficult to adjust to the maternal role [4]. As Trumello et al. [5] asserted, mothers of HRIs regard labor as a negative experience, involving feelings of fear, anxiety, helplessness, and panic. As admission to the NICU is an event that affects both mothers and HRIs, the stress resulting from the NICU environment causes tension and negative emotional and psychological effects during the initial maternal role attainment process, thereby lowering self-confidence [6,7].

As the mother is often the primary caregiver of infants, the mother's emotions and attitudes responsible for affecting the long-term development of infants should be carefully considered [8,9]. A mothers' perceived confidence is an empirical indicator of maternal role attainment, and is essential for a successful transition to the maternal role following childbirth [2]. Maternal self-confidence, which refers to a mother's perception of her parenting skills and understanding of the infant's needs, has been considered a fundamental variable in the maternal role [10], showing that the higher the self-confidence, the more complete the mother feels about her role [11]. Increasing self-confidence in the maternal role during the early postpartum period will help HRI mothers to smoothly accept the maternal role in the future and promote nurturing care for the infant [10].

Although noxious sensory exposure can negatively influence the development of HRIs, appropriate sensory experience is effective in comforting them. Even in healthy full-term infants, early physical contact with their mothers is important for breastfeeding, warmth, stimulation, and maternal attachment. Numerous studies on the benefits of sensory experiences in premature infants show positive results for physiological stability, infant growth, and developmental outcomes [12,13]. While some studies have used improved weight gain [14], others have used decreased feeding intolerance, such as reduced gastric residual volume or vomiting in preterm infants [15]. In addition, evidence suggests that tactile stimulation is effective for vagal activity, gastric motility, and hormone secretion associated with food absorption [16]. In particular, kangaroo mother care is associated with weight gain and length gain in low birth weight infants.

Meanwhile, touch is an important modality through which infants and mothers communicate, and it is also a comforting experience for both [17]. Studies with preterm infants have suggested that kangaroo mother care, alone or in combination, may positively affect maternal role confidence [18] and the acquisition of parental roles [19]. Several studies on the effects of maternal massage in premature infants have claimed that it is effective in relieving anxiety. Skin-to-skin care has also been reported to reduce stress and anxiety in mothers of infants with congenital heart disease. For HRIs in the NICU, studies have indicated that the quantity of early neo-maternal exposure is related to the mother's perception of self-esteem [20].

As touch is the basic form of communication between the mother and infant before verbal communication is formed, infants react differently to different forms of maternal touch, and mothers, in turn, respond to the reactions of the infant. In co-regulated interactions between mother and infant, both the mother and baby dynamically change their own behavior with respect to the ongoing and expected behavior of the other [21]. Mothers of premature infants perform various actions when touching their infants following a pattern of touching from the extremities to the trunk, face, or head [22]. Young infants who are passive participants in the interactions with caregivers react sensitively to subtle changes in maternal touch during the mother-child interaction periods [23], and premature infants who are clinically ill tend to have less motor behavior and show different physiological responses according to the

mother's static or dynamic stroking on their dorsum [24]. These results are in accordance with the finding that touching different locations of the body has different meanings in the prosocial behavior of males and females [25]. Previous studies have shown that maternal contact with HRI is an important interaction between the baby and the mother, and it can be hypothesized that different parts of the infant's body in contact with the mother may have different effects on infant growth and maternal self-confidence.

This study aims to isolate the effects of early maternal touch on different body parts provided to HRIs in the NICU for one week. Further, it aims to investigate the association between maternal touch and infant length, feeding volume, and maternal self-confidence. The specific aims of this study are as following: (1) Assess the level of maternal touch, maternal self-confidence, infant length, and feeding volume; (2) Investigate maternal touch by isolating the infant's body parts (extremities, face/head, and trunk); (3) Identify the associations between maternal touch, maternal self-confidence, infant length, and feeding volume, and ; (4) Identify differences in maternal self-confidence, infant length, and feeding volume in association with the body parts of infants touched by their mothers.

Methods

1. Study design

To identify the association between maternal touch and the growth of infants and maternal self-confidence, data were collected through both observations and surveys for the cross-sectional descriptive correlational study in the NICU environment during a week in the early postpartum period.

2. Setting and participants

Complete enumeration was utilized to recruit dyads of mothers and their infants who were born and hospitalized in the 60-bed level III-IV NICU at S hospital in Seoul, Korea. Between March and November 2017, all newly admitted infants in the unit were considered, and HRIs who met the criteria were recruited if their mothers agreed to participate in the study. To be enrolled in this study, the inclusion criteria for mothers included the following: (1) within seven days postpartum, the earliest time that researchers could access research participants who gave birth to HRIs to minimize the number of uncounted touches; (2) ability to speak, read, and write in Korean; and (3) free of physical or mental illness. Inclusion criteria for infants were as follows: (1) admitted to the NICU immediately after birth, (2) postnatal age under seven days, and (3) medically stable. HRI cases with ventilators, congenital anomalies, severe neurological problems, or fasting were excluded.

In this study, 45 mother-infant dyads were enrolled. The sample size was determined using G*power 3.1.9, based on an effect size of 0.5 [20], with a significance level of 0.05. The two-tailed power level of the study, with 34 mother-infant dyads, was 0.8. Considering the 20% dropout rate, 45 dyads were required. Given the exploratory nature of this preliminary study, the sample size was considered appropriate. Within two to three visits after hospitalization of the selected HRIs, the researcher met with their mothers and collected the data, including the maternal self-confidence questionnaire. Data on infant characteristics, length, and feeding volume were also collected.

3. Instruments

1) General characteristics of mothers and infants

Data on the general characteristics of mothers (age, parity, educational level, occupation, socioeconomic level, planned pregnancy, and marital status) and infants (gestational age, birth weight, APGAR (Appearance, Pulse, Grimace, Activity, and Respiration) score, sex, and delivery method) were collected through a structured questionnaire based on previous research.

2) Maternal self-confidence

A questionnaire was used to assess maternal self-confidence. Maternal self-confidence was measured using Lee's [26] questionnaire, which assesses maternal role self-confidence among the Measures of Maternal Adaptation. Rated on a 4-point Likert scale, this 14-item scale reflects a mother's confidence in her role performance, with higher scores indicating higher maternal self-confidence. In this study, the average scores over multiple measurement scales were used. In Lee's study [26], the scale's Cronbach's α was reported to be .96. In this study,

the internal consistency reliability for maternal self-onfidence variable ranged from .92 (baseline, before touch) to .94 (1-week follow-up, after touch).

3) Maternal touch

Maternal touch was measured by observing how the mother sought to interact with the infant during the visit. An observation checklist was compiled by combining the attachment behaviors of mothers of premature infants identified by Tilokskulchai et al. [22] and the Parent-Infant Caregiving Touch Scale by Koukounari et al. [27]. The items were composed of 3×6 cells so that the infant's contacted body parts (i.e., extremities, trunk, and face/head) were crossed with a combination of the mother's touch intensity and touch type (i.e., touching with fingertip, scratching with fingertip, touching with palm, rubbing with palm, patting, and squeezing). During the visit time, the mothers' behavior was continuously observed by both the researcher and a trained nurse. Higher total scores indicate higher levels of maternal touch. To validate maternal touch counts, the researcher and the nurse in charge simultaneously collected data through direct observation, and the concordance between the two evaluators was recorded.

4) Growth of infants

To assess the growth of infants, their length was measured directly by the first author, and feeding volume was measured using electronic medical records. Infant length refers to the average of the two values (in cm) measured twice at a time from head to toe in the position with both legs fully stretched using the same plastic tape measure. The infants' legs were stretched and measured by two nurses to keep the head in the midline while measuring the length, following the medical center protocol. In this unit, all infants were fed eight meals per day using the same feeding protocol. Enteral feeding of all infants began as soon as possible after birth, and the feeding volume was increased according to weight gain, unless there were signs of feeding intolerance. Most infants received an orogastric or nasogastric tube. While gastric residuals were not checked every three hours, suspected signs of feeding intolerance, such as vomiting, abdominal distension, gross or occult blood in the stool, apnea, bradycardia, and temperature instability, were closely monitored [28]. If any of these warning signs were observed, gastric residuals were measured and the feeding volume was adjusted in consideration of the residual amount. The feeding volume was obtained by measuring the total amount of milk consumed by bottle-feeding or gavage tubes for 24 hours in ml.

4. Procedure

The study was approved by the institutional review board (IRB) (number:2017-02-051-001). The first author educated coworkers about the purpose of the study and the maternal touch checklist beforehand. When the HRI admitted to the NICU met the inclusion criteria, the researcher (the first author) met the mother in consideration of the mother's condition, explained the purpose of the study, and obtained their consent. Maternal self-confidence was measured in a state where the mother had little experience with touch, and the time was approximately 2~3 days postpartum.

Maternal touch provided during the mother's visits was observed and quantitatively measured for one week. At the end of one week of observation, maternal self-confidence was assessed through survey questionnaires.

The researcher obtained information about the next anticipated visit time from the mothers, and when the mother visited, the researcher and the nurse in charge stayed in the same space to observe the mother-infant interaction. In all cases, the researcher observed maternal touch over one hour of visiting and measured it for a week using the checklist. To minimize the error in touch count data, two evaluators simultaneously and independently observed and evaluated maternal touch. Concordance between the two evaluators in the maternal touch measurements was recorded. During the visits, mothers voluntarily engaged in touching behavior; they were not provided with any guidelines that could modify their behavior.

Infants' length and feeding volume were measured daily by the first author and other nurses working in the NICU for a week, starting from the day the mother agreed to participate in the study, following the general procedure of the hospital. Considering the physiological weight loss immediately after birth and the fetal-infant growth chart for preterm infants

(weight, head circumference, and length), we decided to measure the growth of the infants by length. In addition, feeding volume was measured to confirm the degree of adaptation to the extrauterine environment, such as intestinal motility, digestive capability, stable breathing, and increased stomach volume [28]. Infants with a stable medical condition in the study received the same routine care in the same environment, other than the stimulation provided by their mothers. Routine care included feeding (every 3 hours), regular diaper changes, and daily bathing. To minimize confounding stimulation to the infants, all healthcare providers during the research period did not touch or hold infants except for feeding, diaper change, and bathing.

5. Data analysis

Descriptive and bivariate analyses were performed using IBM SPSS Statistics for Windows (version 25.0; IBM Corp., Armonk, NY, USA). Descriptive statistics were used to analyze the participants' characteristics, maternal self-confidence, maternal touch, infant length, and feeding volume. The relationships between maternal touch and the other variables were examined using Pearson's correlations. The Kolmogorov-Smirnov test was used to verify the normality of the distributions. As some variables were not normally distributed, considering the small sample size and consistent application of validation methods to each variable, non-parametric statistical analysis that did not assume the normality of each variable was required [29]. This was performed to prevent a possible bias in the presence of extreme values. Thus, the Mann-Whitney non-parametric test was used to compare the group values of maternal self-confidence, infant length, and feeding volume according to the different degrees of maternal touch over a one-week period. After dividing all respondents into two groups through a median split, Mann-Whitney U tests were conducted to verify the differences in dependent variables between groups. As one of the main objectives of this study was to investigate the relationship between subdivided maternal touch and each dependent variable, the group membership of respondents belonging to both groups through median separation differed for each type of maternal touch. For this non-parametric group comparison, cases were removed from the analysis if the dependent measures included missing values.

Results

1. General characteristics of participants

In this study, the data of 36 of the 45 mother-infant dyads who initially participated were analyzed, excluding infants whose observation period was less than seven days. The patients' general characteristics are listed in Table 1. The average age of

Table 1. Characteristics of mother-Infant dyads (N=36)

Variables	Mother (n=36)		Variables	Infant (n=36)	
	n (%)	M (SD)		n (%)	M (SD)
Age (years)		33.2 (3.68)	Gestational age (weeks)		33.5 (2.3)
Parity			Birth weight (g)		1,855 (533.5)
Primipara	22 (61.1)		APGAR score at 1 min		7.76 (1.35)
Multipara	14 (38.9)		at 5 min		9.09 (0.83)
Educational level			Gender		
High school	4 (11.1)		Men	14 (38.9)	
Undergrad	27 (75.0)		Women	22 (61.1)	
Grad school	5 (13.9)		Delivery method		
Occupation			Vaginal	9 (15.0)	
Yes	19 (52.8)		Cesarean section	27 (75.0)	
Socioeconomic level					
Upper	3 (8.0)				
Middle	24 (67.0)				
Lower	9 (25.0)				
Planned pregnancy					
Yes	23 (63.9)				
Marital status					
Married	36 (100)				

M: mean, SD: standard deviation, APGAR: appearance, pulse, grimace, activity, and respiration, min: minutes.

mothers who participated in the study was 33.2 years. Fourteen mothers were multiparous, but only one had prior experience of delivering an HRI. The majority of mothers had undergraduate degrees (75%), and a little over half were employed (52.8%). In this study, 25% of the mothers reported an economic level below the middle level. Pregnancy was planned in 63.9% of mothers. All infants were born between 25 and 38 weeks of gestational age and received standard NICU care, except for maternal contact during the visit. Infants' mean gestational age was 33.5 weeks and mean birth weight was 1855 g. Infants' APGAR score at one and five minutes was 7.76 and 9.09, respectively. Most infants were female (61.1%) and delivered via cesarean section (75%).

2. Description of maternal touch, maternal self-confidence, infant length, and feeding volume

Upon observing maternal contact for seven days from the time when there was little postpartum contact, 12.1% of all visits did not intend to touch the infant. All contact behaviors were measured using a checklist. As a result of analyzing the behaviors of all mothers who touched their infants, the frequency of maternal touch by contact area was as follows: the count of 'extremities' was 86, 'trunk' was 103, and 'face/head' was 76.

Prior to the analyses, the normality of each variable was checked. Based on the Kolmogorov-Smirnov normality (K-S) test, it was revealed that only the maternal self-confidence variable was normal. All maternal touch variables showed significant K-S statistic values touch on the extremities (K-S=.199, p=.001), on the face/head (K-S=.214, p<.001), and on the body (K-S=.197, p=.001), rejecting the normality assumption. Infant variables such as infant length (K-S=.202, p=.001) and feeding volume (K-S=.161, p=.020) did not hold normality. Thus, there is no pair of variables in which both met the normality condition. Therefore, non-parametric Spearman's rho statistic was used to analyze the association among variables, and the Mann-Whitney non-parametric test was used to compare group differences in later sections.

Descriptive statistics of the variables are presented in Table 2, including maternal self-confidence, infant length, and feeding volume (measured on the first day of study participation and on the seventh day after maternal touch). Based on a comparison before and after maternal touch, maternal self-confidence decreased by an average of 0.12, from 2.17 to 2.05. During the one week of maternal touch, both infant length and feeding

Table 2. One-week comparison of dependent measurement (N=36)

	Baseline (before)		1-week follow-up (after)	
	Mean (SD)	Range	Mean (SD)	Range
Maternal self-confidence	2.17 (0.46)	1.14~3.14	2.05 (0.49)	1.00~3.07
	Median (IQR)	Range	Median (IQR)	Range
Infants' length (cm)	43.0 (41.0~45.0)	36.0~52.0	43.2 (42.5~46.0)	36.0~52.0
Infants' feeding volume (ml/day)	240.0 (178.0~280.0)	24.0~480.0	296.0 (240.0~320.0)	80.0~520.0

SD: standard deviation, IQR: Interquartile range.

Table 3. Spearman correlation coefficients among measurement variables (N=36)

Variables		Maternal touch			Maternal self-confidence	Infants' length	Infants' feeding volume
		Extremities	Face/head	Trunk			
		r_s (p)	r_s (p)	r_s (p)	r_s (p)	r_s (p)	r_s (p)
Maternal touch	Extremities	-					
	Face/head	.323[a] (.055)	-				
	Trunk	.514 (.001)	.618 (<.001)	-			
Maternal self-confidence		.037 (.830)	.285 (.092)	.086 (.617)	-		
Infants' length		−.294 (.082)	−.174 (.310)	.034 (.842)	−.021 (.902)	-	
Infants' feeding volume		.135 (.431)	.302 (.073)	.468 (.004)	.022 (.898)	−.143 (.404)	-

Maternal touch variables are measured as the mean count values of multiple visits and other variables are measured as the differences in mean values of each variable before and after maternal touch.
[a]Spearman correlation coefficient (rho).

volume increased. In terms of median values, the length changed from 43.0 to 43.2 cm while the feeding volume changed from 240.0 to 296.0 ml. For the dispersion of non-normal variables, the interquartile range was used instead of the standard deviation.

3. Associations among maternal touch, maternal self-confidence, infant length, and feeding volume

Table 3 shows the Spearman correlation coefficients for the degree of maternal touch measured by the extremities, face/head, and trunk, and the changes in the average values of maternal self-confidence, infant length, and infants' feeding volume before and after maternal touch. The number of maternal extremity contacts and face/head contacts was positively correlated with the number of trunk contacts (r_s=.514, p=.001; r_s=.618, p<.001). The number of maternal trunk contacts was positively correlated with the change in feeding volume of the HRIs (r_s=.468, p=.004). There was no correlation between maternal self-confidence and the infant variables.

4. Differences in maternal self-confidence, infant length and feeding volume according to maternal touch by infant body parts

Table 4 shows the differences in average values of maternal self-confidence, infant length, and infant feeding volume for one week in the median-split groups with high and low levels of maternal touch by body parts (extremities, face/head, and trunk). The results of the detailed analysis of maternal and infant variables, according to the body part of the infant in contact with the mother using the Mann-Whitney U test (Table 4) showed that the overall touch score was not statistically significantly related to maternal self-confidence. Nevertheless, interestingly, according to the sub-group effect of each body part of the infant touched by the mother, the decrease in the average score of maternal self-confidence in the group with a high level of contact with the extremities was significantly lower than that of their counterparts (Z=−2.27, p=.023). The group with a high level of contact with the face/head also showed a significantly lower decline in maternal self-confidence compared to the other groups

Table 4. Comparison of infant and maternal variables by infants' touched body part (N=36)

	Extremities				Face/head				Trunk			
	Mean (SD)				Mean (SD)				Mean (SD)			
	Low group (n=16)	High group (n=20)	U-statistic	Z (p)	Low group (n=17)	High group (n=19)	U-statistic	Z (p)	Low group (n=16)	High group (n=20)	U-statistic	Z (p)
Maternal self-confidence	−0.232[a] (0.176)	−0.018 (0.308)	89.000	−2.270 (.023)	−0.231 (0.170)	−0.007 (0.313)	86.000	−2.402 (.016)	−0.134 (0.182)	−0.096 (0.338)	153.000	−0.208 (.838)
Infants' length	1.156 (0.926)	0.620 (0.596)	105.000	−1.783 (.083)	1.088 (0.939)	0.653 (0.594)	120.000	−1.339 (.196)	0.806 (0.931)	0.900 (0.691)	134.500	−0.827 (.422)
Infants' feeding volume	5.562 (6.593)	11.625 (8.651)	94.000	−2.114 (.036)	5.941 (6.571)	11.605 (8.888)	101.500	−1.912 (.057)	5.063 (7.316)	12.025 (7.836)	74.500	−2.738 (.005)

SD: standard deviation.
[a]differences in mean values of each variable before and after maternal touch.

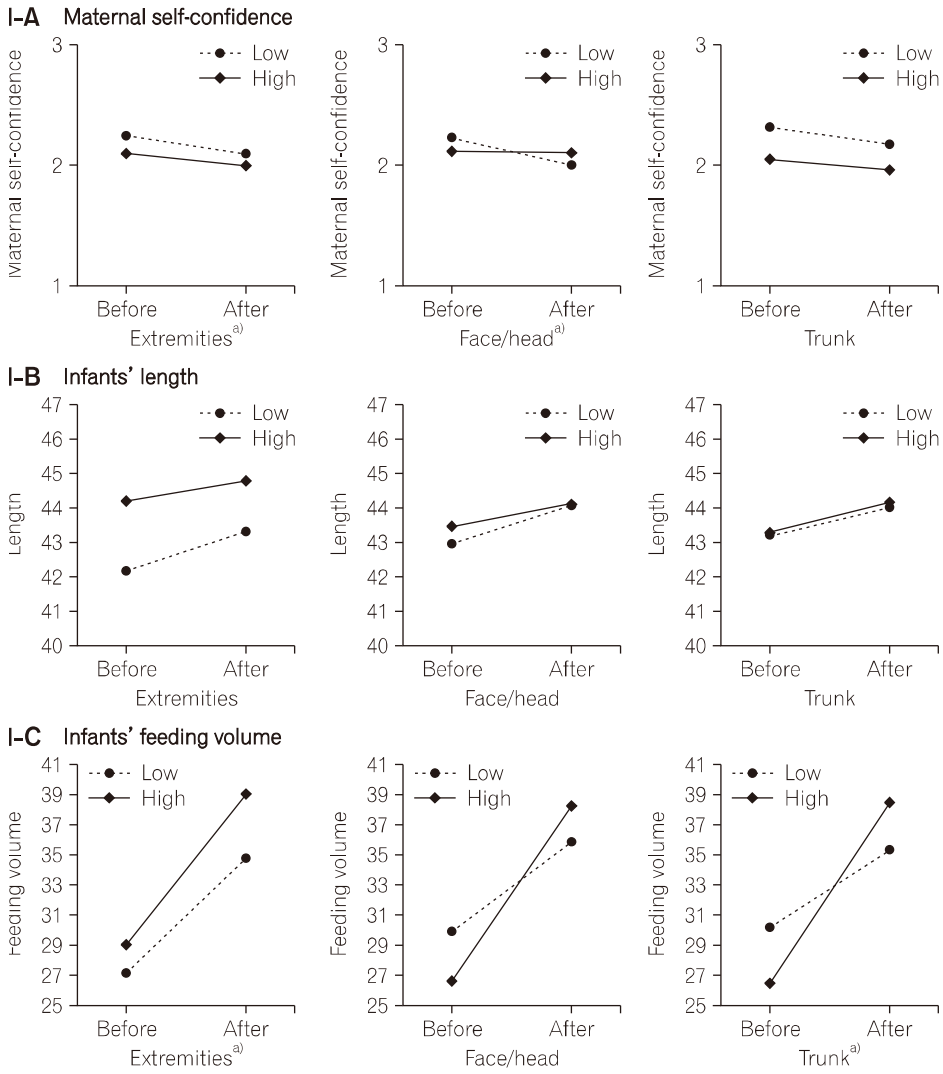

Fig. 1. Mean differences between high touch and low touch groups on body parts. a)statistically significant difference between groups at $p<0.05$.

(Z=−2.40, p=.016).

In Fig. 1, graphs depict the changes in the mean values of maternal self-confidence by body part (extremities, face/head, and trunk) for the groups with high and low maternal touch. For example, the maternal self-confidence of the high head-touch group decreased from 2.12 to 2.10, while the value of the low head touch group decreased from 2.23 to 2.00, showing the largest difference. These graphs suggest that the meaning of maternal touch as a form of communication can differ between mothers and infants. Touch on a certain body part (head) may have a stronger impact on the mother's emotion, whereas touch on another certain part (trunk) may have a stronger impact on the infant's physical development.

For the infant's side, the Mann-Whitney U test revealed that the group with a high degree of maternal contact with the infant's extremities (Z=−2.11, p=.036) and trunk (Z=−2.74, p=.005) had significantly greater changes in feeding volume than the group with a low level (Table 4). The increase in infant length was not correlated with any form of maternal contact.

Discussion

This study analyzed the consequences of different forms of touch on HRI early in life. During a weeklong observation period of maternal touch, the average maternal self-confidence score decreased. This is in accordance with previous findings suggesting that various stresses experienced by mothers of HRIs result in maternal role tension and negative emotional and psychological effects in early maternal role attainment [6,7]. It could be

inferred that physical separation resulting from the baby's admission to the NICU interrupts emotional exchanges and that mothers who have reduced opportunities to interact with and take care of their infants may be vulnerable to maternal role attainment. However, interestingly, we found a significant positive relationship between touching infants' extremities and face/head and confidence in the maternal role. Looking at the sum of the touch scores alone, contact behavior does not appear to be related to mothers' perceptions. Nevertheless, a detailed analysis of each body part revealed that touching infants' extremities and face/head had a positive relationship with maternal self-confidence. Over time, maternal self-confidence decreased by 0.12 points on average, but for mothers who had a lot of contact with their infant's face/head, it was reduced by 0.007 points on average. In contrast, for mothers who had little contact with the infant's face or head, the score dropped significantly to 0.23. Likewise, in the case of mothers who had frequent contact with the infants' extremities, the average decrease in the maternal self-confidence score was small. As it is not possible to compare these results because of the lack of studies on the effects of skin contact by site, further research on the relevance of psychological factors to the contact area is needed. In contrast, maternal self-confidence did not show any correlation with an increase in growth variables, such as infant length and feeding volume. Although research on changes in maternal self-confidence is insufficient for the purpose of comparison, it has been found that mothers who experience kangaroo holding have less depression and more positive perceptions of their infants than mothers who receive standard treatment [30]. Similarly, maternal touch and positive maternal perceptions were positively correlated.

With regard to infants' feeding volume, our findings are consistent with those of Field et al. [31], who showed that tactile stimulation through contact increases the secretion of gastrin and insulin, and ultimately affects weight gain by increasing digestive absorption. In our study, during the initial period of NICU admission, maternal touch on the infant's trunk was statistically correlated with an increase in the feeding volume of the HRIs. Moreover, when examining the areas of the infant bodies being touched, it was found that contact with the extremities and trunk was significantly associated with increased feeding volume. There is no reference for these findings, owing to the lack of studies analyzing the effects of contact sites. However, it has been reported that various forms of massage therapy affect factors related to the growth of preterm infants, for example, increased serum insulin levels, gastric activity, and vagal activity [32]. This result supports our finding that maternal touch to the trunk and extremities is significantly related to increased infant feeding volume from the point of view of the contact area. We did not find a significant difference in length growth in infants who received more maternal touch. Rather, a large change in length growth of babies who had a small amount of touch from their mothers was observed. This study's results contradict the findings that premature infants who received a massage from their mother were significantly taller than other infants [14]. However, our results are consistent with the results of a previous study on multisensory intervention [33], which showed that premature infants who received H-HOPE (Hospital to Home Transition-Optimizing Premature Infant's Environment) grew slower than the control group in the early part of hospitalization but grew faster than the control group after approximately two weeks. The index of infant length is sensitive to long-term periods, and poor growth in length is associated with delayed neurological development [14]. In this study, length growth was measured for a week in the early stage of birth; therefore, additional research is needed to measure length growth for a longer period in the future.

Although this study is exploratory in nature, it shows meaningful results, suggesting that touching different body parts can be related to different meanings for both the mother and infant. Our finding that touching the infants' extremities and face/head is correlated with increased maternal self-confidence reinforces previous research showing that kangaroo mother care helped fathers of premature infants attain their parental role [19]. However, in the case of infants, it was found that the mother's touching of the infants' extremities and trunk was correlated with an increase in the

infant's feeding volume. This result reinforces Kim and Bang's [13] finding in which preterm infants who received a massage in the NICU reached full enteral feeding earlier. In other words, it suggests that physical contact, which is an important means of communication in mother-infant interactions, may have different meanings depending on the body part being touched. To the best of our knowledge, this is the first study to examine maternal touch by dividing the infant's body parts and examining how it is simultaneously related to maternal self-confidence and infant growth at the same time. These interesting results could provide new perspectives for NICU care during the earliest days after birth and advance our understanding of mother-infant interactions. Although consistent findings regarding sensory exposure interventions have not been observed across studies [23], the present results support the use of maternal touch-based interventions in the NICU for mothers and infants. Therefore, in addition to promoting NICU visits, it is important to foster maternal touching behaviors to improve maternal self-confidence and infants' enteral feeding volume.

Finally, our results emphasize the importance of early maternal touch in the NICU environment, where mothers and newborns are separated. Furthermore, it provides empirical evidence that early maternal touch enhances the perception of confidence in the role of the mother and the feeding volume of HRIs. As this study was conducted in one hospital, the results might not be generalizable to all NICUs. Another limitation of this study is that it explored the difference between variables according to touch without controlling for sociodemographic and individual temperament, which could be related to maternal self-confidence, infant length, and feeding volume. However, considering the use of conservative non-parametric statistics to interpret the results, statistically significant results are the basis for contributing to this topic. Future studies should examine the effects of maternal touch by contact area in order to generalize the results. In addition, since maternal self-confidence reflects the mother's psychological state and can be affected by various factors, further research is needed to examine factors other than maternal touch and infant growth, which were limited to one week in this study. HRI is ultimately a member of the family and is raised under the care of the family, including the mother. Nurses caring for patients with HRIs in the NICU need to provide family support by including the family within the domain of the client. Our findings suggest that developing and implementing nursing interventions to encourage effective contact during limited visit times during NICU admissions may be a strategy that can increase confidence in the maternal role and promote continued infant growth.

This study provides evidence to suggest that maternal touch in the early postpartum period is associated with maternal self-confidence and infant feeding volume, and that touching different body parts (extremities, face/head, trunk) may have different meanings for mothers and babies while they are in the NICU. Most mothers are afraid to even touch a newborn baby for the first time, and this is especially true for HRIs. In addition, depending on the general condition of the HRI, holding the baby may be prohibited in the NICU. Based on the present results, we recommend the provision of maternal touch to appropriate body parts to achieve the desired objectives. To increase maternal self-confidence, intervention programs to enhance contact with the infant's face/head or extremities will be helpful, whereas infant feeding volume can be increased by enhancing contact with the trunk or extremities. The research results support the expected effect of kangaroo mother care but also decompose the effect of body parts on infants' physical and mothers' psychological parameters. Based on the findings of this study, one can develop kangaroo mother care practice further to target the specific body part area in practice to improve the physical and psychological aspects. It is important to provide effective touch-based interventions that provide optimal effects to both infants and mothers exposed to vulnerable environments that hinder early contact because of their admission to the NICU. Additionally, it is necessary to find various factors that can influence maternal self-confidence and continue exploring the relationship between touch-based mother-child interaction and long-term mother-child factors.

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Conflicts of interest

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References

1. World Health Organization. 2018. Preterm birth [Internet]. Geneva: World Health Organization; 2018 [cited 2022 May 13]. Available from: http://www.who. int/mediacentre/factsheets/fs363/en/
2. Mercer RT. Nursing support of the process of becoming a mother. Gynecologic & Neonatal Nursing. 2006;35(5):649-651. https://doi.org/10.1111/j.1552-6909.2006.00086.x
3. Cirik VA, Efe E. The effect of expressed breast milk, swaddling and facilitated tucking methods in reducing the pain caused by orogastric tube insertion in preterm infants: A randomized controlled trail. International Journal of Nursing Studies. 2020;104:103432. https://doi.org/10.1016/j.ijnurstu.2020.103532
4. Khoramirad A, Abedini Z, Khalajinia Z. Relationship between mindfulness and maternal stress and mother-infant bonding in neonatal intensive care unit. Journal of Education and Health Promotion. 2021;10:337. https://doi.org/ 10.4103/jehp.jehp_1620_20
5. Trumello C, Candelori C, Cofini M, Cimino S, Cerniglia L, Paciello M, et al. Mothers' depression, anxiety, and mental representations after preterm birth: A study during the infant's hospitalization in a neonatal intensive care unit. Frontiers in Public Health. 2018;6:359. https://doi.org/10.3389/fpubh.2018.00359
6. Youn YA, Shin SH, Kin EK, Jin HJ, Jung YH, Heo JS, et al. Preventive intervention program on the outcomes of very preterm infants and caregivers: A multicenter randomized controlled trial. Brain Sciences. 2021;11(5):575. https://doi.org/10.3390/brainsci11050575
7. He FB, Axelin A, Ahlqvist-Björkroth S, Raiskila S, Löyttyniemi E, Lehtonen L, et al. Effectiveness of the close collaboration with parents intervention on parent-infant closeness in NICU. BMC Pediatrics. 2021;21(1):28. https://doi.org/10.1186/s12887-020-02474-2
8. Bae JY. Construction of a postpartum depression model. Journal of Korean Academy of Psychiatric and Mental Health Nursing. 2002;11(4):572-587.
9. Forcada-Guex M, Pierrehumbert B, Borghini A, Moessinger A, Muller-Nix C. Early dyadic patterns of mother-infant interactions and outcomes of prematurity at 18 months. Pediatrics. 2006;118(1):e107-e114. https://doi.org/10.1542/peds.2005-1145
10. Faisal-Cury A. Postpartum depression and early predictors of lower maternal confidence at 12 to 15 months after delivery. Psychiatric Quarterly. 2021; 92(2):501-511. https://doi.org/10.1007/s11126-020-09813-7
11. Shafaie FS, Mirghafourvand M, Bagherinia M. The association between maternal self-confidence and functional status in primiparous women during postpartum period, 2015-2016. International Journal of Women's Health and Reproduction Sciences. 2017; 5(3):200-204. https://doi.org/10.15296/ijwhr.2017.36
12. Boundy EO, Dastjerdi R, Spiegelman D, Fawzi WW, Missmer SA, Lieberman E, et al. Lieberman E, et al. Kangaroo mother care and neonatal outcomes: A meta-analysis. Pediatrics. 2016;137(1):e20152238. https://doi.org/10.1542/peds.2015-2238
13. Kim HK, Bang KS. The effects of enteral feeding improvement massage on premature infant: A randomized controlled trial. Journal of Clinical Nursing. 2018;27(1-2):92-101. https://doi.org/10.1111/jocn.13850
14. Zhang X, Wang J. Massage intervention for preterm infants by their mothers: A randomized controlled trial. Journal for Specialists in Pediatric Nursing. 2019; 24(2):e12238. https://doi.org/10.1111/jspn.12238
15. Seiiedi-Biarag L, Mirghafourvand M. The effect of massage on feeding intolerance in preterm infants: A systematic review and meta-analysis study. Italian Journal of Pediatrics. 2020;46(1):1-10. https://doi.org/10.1186/s13052-020-0818-4
16. Niemi AK. Review of randomized controlled trials of massage in preterm infants. Children. 2017;4(4):21. https://doi.org/10.3390/children4040021
17. Perez H, Gewirtz JL. Maternal touch effects on infant behavior. In Field T (Ed), Touch and massage in early child development. Miami: Johnson & Johnson Pediatric Institute; 2004. p. 39-48.
18. Lim J, Kim G, Shin Y. Effects for kangaroo care: Systematic review & meta analysis. Journal of the Korea Academia-Industrial Cooperation Society. 2016;17(3):599-610. https://doi.org/10.5762/KAIS.2016.17.3.599
19. Blomqvist YT, Bubertsson C, Kylberg E, Joreskog K, Nyqvist KH. Kangaroo mother care helps fathers of preterm infants gain confidence in the parental role. Journal of Advanced Nursing. 2012;68(9):1988-1996. https://doi.org/10.1111/j.1365-2648.2011.05886.x
20. Ahn YM, Kim MR. The relationship between early neo-maternal exposure, and maternal attachment, maternal self-esteem and postpartum depression in the mothers of NICU infants. Journal of Korean Academy of Nursing. 2005;35(5): 798-809. https://doi.org/10.4040/jkan.2005.35.5.798
21. Jacobsen H, Vang KA, Lindahl KM, Wentzel-Larsen T, Smith L, Moe L, et al. Quality of social interaction in foster dyads at child age 2 and 3 years. Child Psychiatry & Human Development. 2019;50(1):121-131. https://doi.org/10.1007/s10578-018-0823-7
22. Tilokskulchai F, Phatthanasiriwethin S, Vichitsukon K, Serisathien Y. Attachment behaviors in mothers of premature infants: A descriptive study in Thai mothers. The Journal of Perinatal & Neonatal Nursing. 2002;16(3):69-83. https://doi.org/10.1097/00005237-200212000-00008
23. Lourenço V, Coutinho J, Pereira AF. Advances in micronalaysis: Magnifying the social microscope on mother-infant interactions. Infant Behavior and Development. 2021;64: 101571. https://doi.org/10.1016/j.infbeh.2021.101571
24. Manzotti A, Cerritelli F, Esteves JE, Lista G, Lombardi E, La Rocca S, et al. Dynamic touch reduces physiological arousal in preterm infants: A role for c-tactile afferents? Developmental Cognitive Neuroscience. 2019;39:1000703. https://doi.org/10.1016/j.dcn.2019.100703
25. Pausell S, Goldman M. The effect of touching different body areas on prosocial behavior. The Journal of Social Psychology. 1984;122(2):269-273. https://doi.org/10.1080/00224545.1984.9713489
26. Lee YE. An experimental study on the impact of an agreement on the means to achieve nursing goals in the early postpartum period of primiparous mothers and enhance their self-confidence and satisfaction in maternal role performance. The Journal of Nurses Academic Society. 1992;22(1):81-115. https://doi.org/10.4040/jnas.1992.22.1.81
27. Koukounari A, Pickles A, Hill J, Sharp H. Psychometric properties of the Parent-Infant Caregiving Touch Scale. Frontiers in Psychology. 2015;6:1887. https://doi.org/10.3389/fpsyg.2015.01887
28. Georgieff. Nutrition. In MacDonald MG, Mullett MD, Seshia MMK (Eds.). Avery's neonatology: Pathophysiology & management of the newborn. 6th ed. Philadelphia: Lippincott William & Wilkins; 2005. p. 402-406.
29. Hollander M, Wolfe DA, Chicken E. Nonparametric statistical methods. 3rd ed. New Jersey, NJ: John Wiley & Sons; 2014.
30. Fieldman R, Eidelman AI, Sirota L, Weller A. Comparison of skin-to-skin (kangaroo) and traditional care: Parenting outcomes and preterm infant development. Pediatrics. 2020;110(1):16-26. https://doi.org/10.1542/peds.110.1.16
31. Field T. Massage therapy research review. Complementary Therapies in Clinical Practice. 2014;20(4):224-229. https://doi.org/10.1016/j.ctcp.2014.07.002
32. Álvarez MJ, Fernández D, Gómez-Salgado J, Rodríguez-González D, Rosón M, Lapeña S, et al. The effects of massage therapy in hospitalized preterm neonates: A systematic review. International Journal of Nursing Studies. 2017;69:119-136. https://doi.org/10.1016/j.ijnurstu.2017.02.009
33. Whith-Traut RC, Rankin KM, Yoder JC, Liu L, Vasa R, Geraldo V, et al. Influence of H-HOPE intervention for premature infants on growth, feeding progression and length of stay during initial hospitalization. Journal of Perinatology. 2015; 35:636-641. https://doi.org/10.1038/jp.2015.11