

# The Effects of Infant Massage on Weight, Height, and Mother-Infant Interaction

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**Purpose.** The purpose of this study was to test the effects of infant massage (auditory (mother's voice), tactile/kinesthetic (massage) and visual (eye to eye contact) stimulation) on weight and height of infant and mother-infant interaction with normal infants over a period of 4 weeks.

**Method.** This study was designed as a nonequivalent control group pretest-posttest design. The experimental group infants (aged 2-6 months) participated in one of the infant massage programs at the health district center for 4 weeks. The control group (N=26) was paired with the experimental group (N=26) by matching the infant's age and sex. Infant weight, height, and mother-infant interaction were measured two times and recordings of the mother-infant interaction were done using the video equipment in a room at the health center for 10 minutes.

**Results.** After 4 weeks of massage, there were no significant differences weight gain and height increase between the two groups. Comparison of the total scores for the mother-infant interaction between the two groups showed a significant difference ( $t=5.21, p=.000$ ). There were also significant differences on maternal response ( $t=3.78, p=000$ ), infant response ( $t=5.71, p=000$ ) and dyadic response ( $t=4.05, p=000$ ) in the mother-infant interaction between the two groups.

**Conclusion.** Overall, the results of this study reassure that infant massage facilitates the mother-infant interaction for infants and mothers who give massage to their baby.

**Key Words :** infant massage, mother-infant interaction

## INTRODUCTION

Infant massage is a way of comforting skin inputs and nourishment for the healthy development of mind, body and spirit. It is an ancient skill that was practiced centuries ago in most of the world, especially in Asia, and has recently being rediscovered as an effective means of comforting an infant (Mainous, 2002). Since the 1990's, mothers, maternal and pediatric nurses have been eager to learn more infant massage and seeking information for infant massage by enrolling in classes across the nation. The sharing information for infant massage with

mothers and nurses will go far to improve infant health, promote bonding and decrease teenage violence (Field, 2002; Peters, 2002; Steptoe, 2002).

Although the underlying mechanisms of the massage therapy effects on weight gain are yet known, several possibilities have been proposed. One possibility is that massage increases the vagal activity, which, in turn, releases food absorption hormones such as gastrin and insulin, thus explaining weight gain for infants. The other possibility is that extensive stimulation, for example, a full body massage might facilitate the actions on the skin, and soft tissues and muscles promote the circulation of blood and lymph fluids. The nerve endings in the

skin are also stimulated. As a result, nutrients are brought to the tissues and waste products are removed (Field, 2002).

Kim, Shin, and White-Traut (2003) investigated the physiological effects of the massage therapy in 58 instituted infants. For the experimental group, the massage protocol (developed by Field, Grizzle, Scafidi, Abrams, & Richardson, 1996) was applied twice a day, mid-morning and early evening, for 4 weeks by the researcher and the trained research assistants. Infants assigned to the experimental group gained more weight, height, and head circumference than the infants in the control group. The results from others studies on the physiological variables with healthy babies showed that massage improved weight (Field et al., 2004; Kim, 1999) and height (Field et al., 2004) as compared to infants without massage. Blood flow velocity in the femoral artery (Agarwal et al., 2000) and sleep (Agarwal et al., 2000) immediately followed by massage were improved for the massage group compared to the control group. Ferber, Laudon, Kunt, Weller, and Zisapel (2002) reported the possibility of using the massage therapy to enhance the adjustment of the infant's developing circadian system to the night phase in full-term infants.

The early mother-infant relationship which is recognized to be significant for the infant's psychological growth and effective interaction influences later cognitive, emotional, and social development of the infant (Bowlby, 1969). The major consequence of mother-infant interaction is that mothers and infants influence each other so that both are changed for mutual modification (Leitch, 1999). Touch enhances one's general positive feelings and mood and increases attention arousal, which subsequently influences one's evaluation of the external stimuli surrounding the touch situation. Therefore, proper maternal touch including the massage therapy will produce overall positive feelings toward the mother and the environment (Bond, 2002; Field, 2002; Jeon, 2003; White-Traut, 2004).

Choi and Kim (2002) studied the effect of infant massage on the mother-infant interaction with 49 healthy infants. Twenty five mothers of the experimental infants gave infant massage (developed by Field et al, 1996) 10 to 20 days after delivery when the mothers stayed at the Sanhujoriwon (a kind of postpartum care center). In the post-test, the researcher videotaped both the control group and the experimental group while visiting their homes for 4 weeks after delivery to observe the mother-

infant play interaction. The mother-infant play interaction (Mother-Infant Play Interaction Scale, MIPIS, Walker & Thompson, 1982) for the mothers who gave their infant a massage was more active than the other mothers who did not. Each subscale showed significant differences on mother responses, infant responses and dyadic behavioral responses. Glover, Onozawa, and Hodgkinson (2002) also studied the mother-infant interaction effects of infant massage on healthy infants. The mother-infant interaction for the control group remained the same during the period of the trial. However, it was improved greatly for the massage group. The result confirmed with the study of Onozawa, Glover, Adams, Modi, and Kumar (2001) that infant massage improved the mother-infant relationship. Clarke, Gibb, Hart, and Davidson (2002) described that infant massage gives the opportunity for a closer mother-infant relationship, enabling the mother to know her baby in greater detail, and enhancing her responsiveness to her baby. Mothers reported infant massage help specific problems that their infant had, for example, colic and poor sleep. Mothers also felt they were communicating better with their infant and understood their infant's needs much better, showing positive benefits for the use of infant massage (Clarke et al., 2002).

Although much research on the effects of infant massage has been done with premature babies (Bond, 2002; Field, 2002; Mainous, 2002), very little study has been conducted on infant massage with healthy infants in Korea. The purpose of this study was to evaluate the effects of massage therapy (auditory (mother's voice), tactile/kinesthetic (massage) and visual (eye to eye contact) stimulation) on weight gain, height increase and maternal-infant interaction with healthy infants.

### *Hypothesis*

1. The infants in the experimental group who received massage for 4 weeks had a more weight gain than those in the control group who did not.
2. The infants in the experimental group who received massage for 4 weeks had a more height increase than those in the control group who did not.
3. The infants in the experimental group who received massage for 4 weeks had a better mother-infant interaction than those in the control group who did not.

## METHODS

### *Study design and Sample*

This study was designed as a nonequivalent control group pretest-post-test design. Subjects (mother-infant dyads) were recruited from the participants of the infant massage program or a routine well-baby clinic at the health district center. The convenient sampling was used to select the sample and the matching method was used to control extraneous variables such as age and sex. The sample included infants who met the following criteria: (1) age of infant between 2 to 6 months, (2) no premature baby at birth, (3) no special treatment contraindicating the administration of infant massage.

**Experimental Group:** Potential mother-infant dyads for the experimental group had been recruited and participated one of the infant massage programs, which were held at the C health district center.

Thirty two mother-infant dyads at the age of 2 to 6 months participated in the infant massage programs and the infants did not receive any massage or other interventions after birth. Thirty two mothers agreed to provide infant massage to their infant more than 4 days per week for a 4-week period at their home. All mothers in the experimental group were given a printed protocol for massage and asked to record whether they provided massage to their infant or not. To confirm the compliance, the record was checked weekly when the mother-infant dyad participated in the infant massage program. To remind them of the participation in the infant massage program, a research assistant telephoned the mothers 2 or 3 days before they had to come to the health district center. Five infants in the experimental group did not complete the study. The main reason for the dropout was that they could not attend all the courses in the infant massage program and did not provide infant massage to their infant more than 4 days per week. Finally, the remaining subjects for the experimental group were 26 mother-infant dyads.

**Control Group:** The control group consisted of the mother-infant dyads that did not attend the infant massage program, and only visited a routine well-baby clinic at the health district center. If the mothers in the control group had given the structured massage or any other intervention to their infant since birth, the dyad was excluded from the data sample. From the follow-up reports at the end of this study, they did not give structured mas-

sage to their infant, and only used occasional touch for soothing their infant. The 110 mother-infant dyads in the control group were initially at the beginning of the study. To encourage the visit to the health district center, the research assistant telephoned the mothers 2 or 3 days before the appointed day. Seven infants from the control group did not complete the study because of inconvenience with time. Each mother-infant dyad in the control group was paired to a dyad in the experimental group by matching the infant's age and sex. Because the infant's weight and height, and mother-infant interaction changed with age and sex (Leitch, 1999), the two groups were matched by the two variables. Finally, the data from the control group was conducted with 26 among the 103 mother-infant dyads in the control group.

### *Data Collection Procedure*

Data were collected at two points in time. At the beginning of the study, the infant's weight and height and mother-infant interaction as well as sex, age, birth weight, height at the birth, feeding method, delivery method, and order of baby and mother's report of infant temperament were collected. Also the mother's age, marital status, education level and job were collected. The 4 weeks after the beginning of the study, the infant's weight and height and mother-infant interaction were collected again at the same health district center where an average of 15 minutes was spent with each mother-infant dyad in a private room and the video recording of the mother-infant interaction lasted for 10 minutes. The study protocol and consent form were approved by the Ethics Committee at the C health district center. Consents were obtained from all the mothers.

### *Massage class*

The mother-infant dyads in the experimental group attended the weekly infant massage program at the health district center for 4 weeks, which lasted for one hour from 11 am every Wednesday. Instructors were trained according to the procedures developed by Field et al. (1996), and taught the techniques for infant massage by encouraging the mothers to observe and respond to their infant's body language and cues and adjust their touch accordingly.

Instructors taught that massage would be initiated one hour before feeding and the massage procedure could be modified according to the infant's response to avoid a negative reaction such as crying, fidget, and behavioral

distress (Burns, Cunningham, White-Traut, Silvestri, & Nelson, 1993). Massage is the best when the infant is in a quiet alert state. Engagement cues include bright-eyed focused expression, still/calm attentiveness, and clarification for starting a massage with soft voice. Throughout the massage period, the mother tried to engage the eye-to-eye contact and talk with her infant. If the infant indicated that he or she was not good mood, the massage was discontinued or (and) the next procedure of the massage was attempted.

The instructor demonstrated the massage strokes on a doll, while the mother worked with her own infant. The massage began with slow rhythmic strokes, as the mother's speed and timing were guided by the infant's body signals. The mother placed a small amount of oil on the palms of her warm hands and worked over each part of the infant's body according to the massage protocol (Field et al., 1996). Each massage consisted of 5 minutes of tactile stimulation, followed by 5 minutes of kinesthetic stimulation, and concluded with another 5-minute period of tactile stimulation. The first tactile stimulation consisted of placing the infant in a supine position and five one-minute intervals, consisting of six 10-second periods of stroking, were applied to the following body regions: legs/feet, arms, chest, abdomen, and face. For the kinesthetic stimulation, the infant was placed in a supine position. Each of the five one-minute segments consisted of six passive flexion/extension movements lasting approximately 10 seconds each. These movements occurred in the following sequence: right arm, left arm, right leg, left leg, and both legs simultaneously. During the last tactile stimulation, the infant was placed prone and five one-minute intervals, consisting of six 10-second periods of stroking, were applied to the following body regions: head, neck, back, both legs, and both arms simultaneously.

### **Variables**

#### **Weight and Height**

Infant weight was measured using the Cas electronic scale (Cas Korea Co. Model Ad-T) prior to the beginning of the massage program (baseline), after 4 weeks when the massage class ended at the health center. Infant height was measured using a height scale (Munhwa Co.).

To ensure reliability of the measures, a research assistant was trained by the investigator to collect infant weight and height. Height data were collected in triplicate at each time, and then averaged.

#### **Mother's Perception of Infant Temperament**

Temperament is defined as the individual's emotional reactivity or behavioral style in interacting with the environment. The Mother's Perception of Infant Temperament Scale was modified from the Infant Temperament Questionnaire (Carey & McDevitt, 1978). This scale has 13 statements that the mother rates regarding physiological requirements, such as nourishment and adequate body temperature, and contact requirements, such as physical closeness and manipulation. To complete the scale, the mother reported her perception on each item as almost never, sometimes, usually, almost always characteristic of her baby. The items were rated from often to never with weightings of 1 to 4 such that 4 always represented a more positive situation (higher attachment). The Cronbach alpha reliability was .80.

#### **Mother- Infant Interaction**

Recordings of the mother-infant interaction were done using the video equipment in a room at the health center. The mother-infant interaction was recorded for 10 min. The mother was asked to simply play with her infant as she would at home. The MIPIS (Walker & Thompson, 1982) was used to measure the quality of mother-infant interaction. The scale consisted of 15 items with a 5-point scale (a higher rating being optimal), related to maternal, infant and dyadic behaviors that are independently scored. Infant subscales of the MIPIS were comprised of 3 items: expressed affect, response and visual interaction. Maternal subscales were organized into 10 items: holding style, expression of affect, care giving style, visual interaction, style of play interaction, vocalization styles (tone, content, and quantity of contingency), attempts at smile elicitation and kinesthetic quality of interaction. Dyadic behavioral subscales included 2 items: dyadic quality of interaction and synchrony of affect. A score for each subscale was obtained by averaging the total scores of each subscale.

Videotapes of the mother-infant interaction were analyzed and scored by a rater who was blind to the group membership. To ensure inter-rater reliability of the coding on MIPIS, the rater was first trained to a criterion of 90% reliability prior to evaluating mother-infant interaction. To maintain higher than 90% inter-rater reliability on the scoring of the MIPIS between the investigator and the rater, inter-rater reliability was calculated every 15 tapes. Internal consistency with coefficient alphas for this study ranged from 0.83 to 0.92.

### Data Analysis

A minimal sample size of 25 per group was needed to show a significant effect of massage with the power of 80% power in detecting group differences of 1 standard deviation at the .05 levels (Cohen, 1988). These calculations were based on the large effect size ( $f=.80$ ) found from the pilot study (Hwang, 2003).

Independent t-tests and Chi-square analyses conducted to determine whether the demographic characteristics of the two groups were equivalent prior to initiation of the massage. The independent t-tests were done to compare weight gain, height increase, and the mother-infant interaction for the two groups.

## RESULTS

### Characteristics of the subjects

Characteristics of the infants and the mothers are described in Table 1. There were 10 male infants (4 at 2 months, 2 at 4 months, 1 at 5 months, and 3 at 6 months) and 16 female infants (3 at 2 months, 3 at 3 months, 4 at 4 months, 3 at 5 months, and 3 at 6 months) in the experimental group. There were also 10 male infants (4 at 2 months, 2 at 4 months, 1 at 5 months, and 3 at 6 months) and 16 female infants (3 at 2 months, 3 at 3 months, 4 at 4 months, 3 at 5 months, and 3 at 6 months) in the control group. The age and sex of the two groups are same because of attempting to match the groups on age and sex. The homogeneity of the massage and control groups was tested with t- test and chi-square test. There were no statistically significant

differences between the two groups for the infants' weight, height, sleeping hours per day, temperament, birth order, methods of feeding, and hospitalization when the study started. Because mother's job could influence the mother-infant interaction (Leitch, 1999), the researcher attempted to match the groups based on it. However, more mothers in the control group had a job than those in the massage group ( $\chi^2=8.09$ ,  $p=.01$ ) (Table 1).

### Weight and Height

The mean weight gain and height increase for the experimental group and the control group are shown in Table 2. The initial average weight was 7.08 kg (SD =1.44) for the experimental group and 6.94 kg (SD =1.46) for the control group. After 4 weeks of massage, there were 7.96 kg (SD =1.44) for the experimental group and 7.67 kg (SD =1.31) for the control group. There was, however, no statistically significant difference weight gain between the two groups. The initial average height was 64.14 cm (SD =5.54) for the experimental group and 63.93 cm (SD=4.95) for the control group. The height increase was 66.92 cm (SD =5.61) for the experimental group and 65.99 cm (SD =4.65) for the control group after 4 weeks. A statistically significant difference for height increase was not identified between the two groups.

### Mother-Infant Interaction

The initial total scores for the mother-infant interaction were 64.27 (SD =3.24) for the experimental group and

**Table 1.** Characteristics of the Subjects

	Experimental (N=26)		Control (N=26)		$\chi^2$ or t (p)
	M	SD	M	SD	
Infant Weight at entry (Kg)	7.08	1.44	6.94	1.46	.34 (.73)
Infant Height at entry (Cm)	64.14	5.54	63.93	4.95	.75 (.89)
Infant Sleeping hours per day (hrs)	15.46	2.55	13.54	4.70	1.83 (.07)
Infant Temperament	39.00	6.38	38.92	4.15	.05 (.96)
Mother's Age (yrs)	29.50	4.50	29.84	4.20	.29 (.78)
No. of Family	3.88	1.14	3.53	1.27	1.03 (.31)
Infant's Age (2/3/4/5/6 months)	7/3/6/4/6/		7/3/6/4/6/		
Infant's Sex (male/female)	10/16		10/16		
Infant Birth Order (1st/2nd/3rd)	13/10/3		18/5/3		2.47 (.29*)
Type of Feeding (Breast/Bottle/Mixed)	12/12/2		6/19/1		3.91 (.14*)
Infant Hospitalization (Yes/No)	2/24		2/24		
Marital status of Mother (married/non-married)	26/0		26/0		
Education of Mother (high school/college)	15/11		15/11		
Job of Mother (Yes/No)	0/26		7/19		8.09 (.010*)

\*Fisher's Exact test

62.07 (SD =2.31) for the control group, as shown in Table 3. The initial scores of the maternal subscale, infant subscale, dyadic subscale and total scores for the mother-infant interaction did not show significant differences between the two groups. The total scores for the mother-infant interaction in the experimental group increased from 64.27 to 70.50. Comparison of the total scores of the mother-infant interaction between the two groups showed a significant difference ( $t=5.21, p=.000$ ). There were also significant differences for the maternal response ( $t=3.78, p=0.000$ ), infant response ( $t=5.71, p=0.000$ ) and dyadic response ( $t=4.05, p=0.000$ ) in the total mother-infant interaction between the two groups.

To compare the specific trend of each response, each of the 3 responses was analyzed. There were significant differences on the 8 items of the mother's response except 'holding type' and 'care giving style'. All items in the infant response such as 'predominant response level', 'predominant mood/affect' and 'visual interaction'

showed significant differences between the two groups. Also, there were significant differences for all items of the dyadic response. The scores for 'over-all dyadic quality interaction' in the dyadic response were 4.35 (SD=.49) for the experimental group and 3.96 (SD=.19) for the control group. The score ( $M=4.76, SD=.43$ ) for 'synchrony of affect' in the experimental group was significantly higher than the score ( $M=4.07, SD=.48$ ) of the control group in the dyadic response.

## DISCUSSION

Although a number of massage therapy studies on premature infants have been conducted, there is a dearth of research on the effects of massage therapy with normal infants in Korea. The rationale of this study was that the massage therapy might be one of effective methods on promoting infant's growth and mother-infant interaction. The purpose of this study was to test the effects of mas-

**Table 2.** Changes in Infant's Weight and Height between the Two Groups

	Experimental (N = 26)		Control (N = 26)		t (p)
	M	SD	M	SD	
Weight Pre-test	7.08	1.44	6.94	1.46	.34 (.73)
Post-test	7.96	1.44	7.67	1.31	
Differences between post-and pre-test	.88	.46	.73	.40	
Height Pre-test	64.14	5.54	63.93	4.95	.75 (.89)
Post-test	66.92	5.61	65.99	4.65	
Differences between post-and pre-test	2.78	1.79	2.07	1.48	

**Table 3.** Comparison of Mother-Infant Interaction on MIPIS between the Two Groups

	Experimental (N = 26)		Control (N = 26)		t (p)	
	M	SD	M	SD		
Mother Response	Pre-test	43.46	2.35	42.00	1.91	2.46 (.018*)
	Post-test	47.53	1.10	43.23	1.70	
	Differences between post-and pre-test	4.08	2.94	1.23	2.48	
Infant Response	Pre-test	12.81	.80	12.46	.86	1.50 (.14)
	Post-test	13.85	.73	12.50	.81	
	Differences between post-and pre-test	1.04	.72	.04	.53	
Dyadic Response	Pre-test	8.00	.89	7.52	.57	1.85 (.071)
	Post-test	9.12	.65	8.04	.53	
	Differences between post-and pre-test	1.12	.65	.42	.57	
Total Mother-Infant Interaction	Pre-test	64.27	3.24	62.07	2.31	2.81 (.007**)
	Post-test	70.50	1.36	63.77	1.90	
	Differences between post-and pre-test	6.23	3.45	1.69	2.78	

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

sage therapy by comparing the experimental group and the control group over a period of 4 weeks.

The total scores for the mother-infant interaction in the experimental group significantly increased from 64.27 to 70.50 after giving infant massage for 4 weeks, whose comparison of the total scores between the two groups showed a significant difference ( $t=5.21, p=.000$ ). There were also significant differences on the maternal response ( $t=3.78, p=.000$ ), infant response ( $t=5.71, p=.000$ ) and dyadic response ( $t=4.05, p=.000$ ) for the total mother-infant interaction between the two groups. These results are consistent with the recent reports of Choi and Kim (2002), Glover et al. (2002), Hwang, (2003) and Onozawa et al. (2001) and confirm that infant massage improves the mother-infant relationship. Choi and Kim (2002) studied the effect of infant massage on primipara's mother-infant interaction with 49 healthy infants. They used the same scale (MIPIS) to test the mother-infant interaction as did in this study. On each item for the mother response, 9 items showed a significant difference except 'style of play'. They interpreted this result that infant massage might facilitate mother's sensitivity to her infant. Kwon (1998) reported that the mothers who were 4 weeks after delivery especially showed lower 'visual interaction', 'express of affect' and 'kinesthetic quality of interaction' in the mother-infant interaction. However, the results of the present study and Choi and Kim (2002) showed that the experimental group showed a greater significance than the control group for 'visual interaction', 'express of affect' and 'kinesthetic quality of interaction' in the mother response. These results could interpret as the effects of infant massage. Blehar, Lieberman, and Ainsworth (1977) suggested that mothers initiated the great majority of the episodes and played the leading role than did their infants during the early mother-infant interaction. Maternal behaviors largely determined whether the infant responded positively with smiling, vocalizing, or bouncing, or merely met her gaze. Leitch (1999) suggested that because the innate characteristics of the infant are difficult or impossible to be altered, the intervention program to promote the mother-infant interaction has to focus on the behaviors of the mother or primary caregiver to increase competence of the parents in interpreting and responding to the infant's communication cues. In the experimental group, 'express of affect', 'visual interaction', 'vocalization', and 'smile elicitation' were significantly higher than the control group, whose results could interpret that

the mothers in the experimental group appropriately alleviated infant's distress and promoted more growth fostering behaviors than the mothers in the control group did. The mothers who participated in the experimental group in this study also reported that they themselves had benefited, for example, by feeling "closer" to their infant and less stressed.

The experimental group was significantly higher than the control group on the all 3 items of the infant response and the all 2 items of the dyadic response in this study. However, only 2 items, 'predominant mood/affect' and 'over-all dyadic quality interaction' for the experimental group were significantly higher than the control group in the results of Choi and Kim (2002). These discrepancies were due to that the ages of the samples varied. Bang (1991) reported that there was a significant increase in the mother-infant interaction with the increase of the infant's age. The infant's ages in the present study were from 2 to 6 months and the ones in Choi and Kim (2002) were from 10 days to 4 weeks after delivery. Because the age of the infants in the present study was older than the ones in Choi and Kim (2002), the mother-infant interaction in this study was higher than the ones in Choi and Kim (2002).

When the massage program was finished, all mothers in the experimental group had a chance to express their feeling after they massaged to their infant. The mothers in the experimental group reported such as 1) mother herself increased a concern for her infant's growth and developments; 2) when the infant's father was involved with massage, all family felt that they were happy and had a good time; and 3) when the mother tried to give massage to her infant first, some infants cried or disliked it. However, some other infants showed happy and lay back automatically when they realized that the mother started the massage. Some mothers reported that they did not realize that time was going by such quickly because they were talking and making a contact frequently through infant massage. Some mothers felt that they became to love the infant more and thought the baby was cuter. During the abdominal massage in the massage program at the health district center, an infant had gas passing. All mothers in the program were astonished and some of them felt the effects of infant massage.

Although the initial weight was similar when the massage program started, after 4 week of massage the weight increased for the experimental group as compared to the control group. However, mean weight and

weight gain did not show a significant difference between the two groups. The failure to find any statistical difference between the two groups for the mean weight gain is not consistent with the reports in Kim (1999) and Kim et al. (2003). Kim (1999) and Kim et al. (2003) reported that body weight for the sensory stimulation group (11 orphaned infants of 2 weeks old when the program started) was significantly increased more than the control group (12 orphaned infants) after 4 weeks. These discrepancies were due to the number of massage a day. The all infants of the experimental group in the studies of Kim (1999) and Kim et al. (2003) received massage twice a day. However, in the present study, the infants in the experimental group received massage only 1 time a day. The infants in the two studies (Kim, 1999; Kim et al 2003) also lived in an orphanage where it lacked or deprived of sensory stimuli than the infants who lived with family. In this study, all infants lived with their family. So, the differences of weight increase in the two studies were greater than ones in this study. Moreover, the results from Agarwal et al. (2000) and Hwang (2003) did not show a significant differences on the weight gain with normal babies who lived with their family.

The increases of height for the experimental group were greater than the control group. However, there was no statistically significant difference between the two groups. This result is consistent with the reports from Agarwal et al. (2000) and Kim (1999), but inconsistent with the result from Kim et al. (2003). These discrepancies about the effects of massage on weight and height suggests that it is necessary to perform repetition experiments with a greater size of samples and the number of massage a day, and a longer period of massage. Also, there is need to collect other physiological parameters such as brain wave, serum protein and stomach movement (Jeon, 2003).

## CONCLUSION

Mother-infant interaction between a mother and her infant has evolutionary survival values to human species (Bowley, 1969), requiring the mother's continuous concern to the infant's signals. The present study showed that massage was associated with an improved infant behavior and increased maternal concern to the infant, which may ultimately promote to increase a positive mother-infant interaction. These findings suggest that

massage is one of the interventions to make an active mother-infant interaction, and may thus promote building up the emotional tie between the mother and her infant. The results from this study present empirical supports that massage facilitates almost all part for comforting feelings to the mother and her infant such as closeness, warmth, care, contact, and affection.

From the finding of this study, nurses at the health district center or hospital should teach the massage method to the mothers who have an infant to provide a chance to increase bond and affection between the mother and the infant. Even though the parents reported that infant massage is one of the most commonly intervention methods for their infant (Loman, 2003), pediatric nurses should provide quality controls such as accurate and standardized massage method.

Although the infants in the control group were selected by matching the age and sex in the experimental group, the number of the infants with the same age and same sex may not be sufficient to exclude the effects of possible confound variables such as gender and age at entry. Also, even the researcher asked that the mothers in the experimental group should give massage to their baby at least 4 times a week and the mothers in the control group who would give any interventions to their baby during the study were excluded, possible confound variables such as mother's job, mother's characteristics, or the number of family members could not be controlled.

While the infants with massage did not exhibit a significant increase in weight and height than the infant in the control group, the findings should be interpreted with caution. Important limitations in this study were that the number of massage a day was less than what it was in other studies and the quality of massage might have been different because each mother gave massage to her own infant. So, it is difficult to conclude that the massage effect is not clear to promote weight and height. In order to see the effects of massage in weight and height between the experimental group and the control group, the number of massage a day and the quality of massage must be controlled. Other important limitations in the study were that the sample size, the number of the infants with the same age between the two groups and the days of massage were not sufficient to see the effect of massage on weight and height. A larger number of the infants with the same ages and longer days of massage would have been examined for weight and height.



In terms of future research directions, if the number of sample, the same ages, and the number of massage a day, and the days of massage will be increased, it may be rewarding to evaluate the efficacy of massage.

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