EFFECTS OF MULTI-MODALITIES SENSORY STIMULATION PROGRAM ON THE GROWTH OF PREMATURE INFANTS AND MATERNAL INFANT ATTACHMENT

POONSIN CHAROENSRI

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF NURSING SCIENCE (PEDIATRIC NURSING)
FACULTY OF GRADUATE STUDIES
MAHIDOL UNIVERSITY
2002

ISBN 974-04-2263-2

Thesis
entitled

EFFECTS OF MULTI-MODALITIES SENSORY STIMULATION PROGRAM ON THE GROWTH OF PREMATURE INFANTS AND MATERNAL INFANT ATTACHMENT

Poonsin Charoensri
.....
Pol.capt.Poonsin Charoensri
Candidate

Jariya Wittayasooporn
.....
Asst.Prof.Jariya Wittayasooporn, DNS.
Major-Advisor

Autchareeya Patoomwan
.....
Lect.Autchareeya Patoomwan, Ph.D.
Co-Advisor

Nares Wongpitoon
.....
Pol.lt.col.Nares wongpitoon, M.D.
Co-Advisor

Liangchai Limlomwongse
.....
Prof.Liangchai Limlomwongse, Ph.D.
Dean
Faculty of Graduate Studies

Yuwadee Luecha
.....
Assoc.Prof.Yuwadee Luecha, Ed.D.
Chair
Master of Nursing Science
Faculty of Medicine
Ramathibodi Hospital

Thesis
entitled

EFFECTS OF MULTI-MODALITIES SENSORY STIMULATION PROGRAM ON THE GROWTH OF PREMATURE INFANTS AND MATERNAL INFANT ATTACHMENT

was submitted to the Faculty of Graduate Studies, Mahidol University
for the Degree of Master of Nursing Science (Pediatric Nursing)
on
August 8, 2002

Poonsin Charoensri.
.....
Pol.capt.Poonsin Charoensri
Candidate

Jariya Wittayasooporn
.....
Asst.Prof.Jariya Wittayasooporn, DNS.
Chair

Fongcum Tilokskulchai
.....
Assoc.Prof.Fongcum Tilokskulchai, Ph.D.
Member

Autchareeya Patoomwan
.....
Lect.Autchareeya Patoomwan, Ph.D.
Member

Wantana Maneesriwongul
.....
Lect.Wantana Maneesriwongul, DNSc.
Member

Nares Wongpitoon
.....
Pol.lt.col.Nares wongpitoon, M.D.
Member

Liangchai Limlomwongse
.....
Prof.Liangchai Limlomwongse,
Ph.D.
Dean
Faculty of Graduate Studies
Mahidol University

Prakit Vathesatogkit
.....
Prof.Prakit Vathesatogkit,
M.D., ABIM., FRCP.
Dean
Faculty of Medicine, Ramathibodi Hospital
Mahidol University

ACKNOWLEDGEMENT

This study could not successfully completed without the assistance of many people. I would like to thank Asst.Prof.Dr.Jariya Wittayasooporn, Lect.Dr.Autchareeya Patoomwan, Pol.lt.col.Nares Wongpitoon my major and co-advisors for their guidance, valuable advice, and encouragement throughout the working process. I am also appreciative to Assoc.Prof.Dr.Fongcum Tilokskulchai and Lect.Dr.Wantana maneesriwongul for their constructive comments and suggestions.

Grateful acknowledgement is extended to the experts for their assistance in validation of the instrument. I would like to thank all mothers of premature infants who willingly participated in this study, and also the ward staff and personnel of high-risk unit and out patient pediatrics clinic of Police General Hospital for their cooperation in data collection.

I wish to acknowledge the financial support for conducting the research from Thesis Grant, Mahidol University. Special thanks to my old friend, Mrs.Montakarn Techa-sawatwit Master of Arts in teaching who spent her free time for editing my thesis. I am also particularly indebted to the Police General Hospital for providing time that enabled me to undertake this study.

Finally, I would like to express my gratitude to my family, classmates in Ramathibodi Nursing Graduate Program, and other colleagues for their love, warmth, and support

Poonsin Charoensri

4236647 RAPN/M : MAJOR : PEDIATRIC NURSING ; M.N.S. (PEDIATRIC NURSING)
KEY WORDS : MULTI-MODALITIES SENSORY STIMULATION PROGRAM/ PREMATURE INFANT/ GROWTH OF PREMATURE INFANT/ MATERNAL INFANTATTACHMENT

POONSIN CHAROENSRI: EFFECTS OF MULTI-MODALITIES SENSORY STIMULATION PROGRAM ON THE GROWTH OF PREMATURE INFANTS AND MATERNAL INFANT ATTACHMENT. THESIS ADVISORS: JARIYA WITTAYASOOPORN, DNS., AUTCHAREEYA PATOOMWAN, Ph.D., NARES WONGPITOON, M.D., 100 p. ISBN 974-04-2263-2

The purpose of this quasi-experimental research aimed to compare the growth of premature infants and maternal infant attachment between a control group and an experimental group under the multi-modalities sensory stimulation program, based on conceptual framework of the synactive theory and maternal infant attachment theory. The selected sample was 40 pairs of mothers and their premature infants in the high-risk unit at Police General Hospital, 20 pairs for each group. The control group received only conventional nursing care. The experimental group received both conventional nursing care and the multi-modalities sensory stimulation program. Growth of infants was assessed by weighing and measuring body length and head circumference. The Maternal Attachment Inventory (MAI) was used to measure maternal infant attachment. Data were analyzed using t-test and analysis of covariate (ANCOVA)

The results showed that at one month after delivery the growth of premature infants in the experimental group was significantly higher than in the control group ($p < .05$). And the mean of maternal infant attachment scores in the experimental group was significantly higher than the control group ($p < .05$).

This resulted in the conclusion that enhancing maternal infant interaction with multi-modalities sensory stimulation program enabled beneficial effects directly in premature infants and enhanced maternal infant attachment, as well. Therefore, mothers of premature infants should be encouraged to continually provide this type of program to infants in daily care, especially in the first months of life.

4236647 RAPN/M : สาขาวิชา : การพยาบาลเด็ก ; พย.ม. (การพยาบาลเด็ก)

พูลสิน เจริญศรี : ผลของโปรแกรมการกระตุ้นประสาทสัมผัสหลายรูปแบบต่อการเจริญเติบโตของทารกเกิดก่อนกำหนด และ สัมพันธภาพระหว่างมารดากับทารก (EFFECTS OF MULTI-MODALITIES SENSORY STIMULATION PROGRAM ON THE GROWTH OF PREMATURE INFANTS AND MATERNAL INFANT ATTACHMENT) คณะกรรมการควบคุมวิทยานิพนธ์: จริยา วิทยะศุภร พย.ด., อัจฉรียา ปทุมวัน Ph.D., นาเรศ วงศ์ไพฑูรย์ พ.บ. 100 หน้า
ISBN 974-04-2263-2

การศึกษาครั้งนี้เป็นการวิจัยกึ่งทดลอง มีวัตถุประสงค์เพื่อศึกษาผลของโปรแกรมการกระตุ้นประสาทสัมผัสหลายรูปแบบ ต่อการเจริญเติบโตของทารกเกิดก่อนกำหนด และสัมพันธภาพระหว่างมารดากับทารก โดยใช้กรอบแนวคิด the synactive theory และทฤษฎีความรักใคร่ผูกพันของคลอสและเคนเนล กลุ่มตัวอย่างเลือกแบบเจาะจง จำนวน 40 คู่ คือ มารดากับทารกเกิดก่อนกำหนด ในหน่วยทารกแรกเกิดมีปัญหา โรงพยาบาลตำรวจ โดยแบ่งออกเป็น 2 กลุ่ม กลุ่มละ 20 คู่ ทั้งสองกลุ่มได้รับการพยาบาลตามปกติ กลุ่มทดลองได้รับการกระตุ้นด้วยโปรแกรมการกระตุ้นประสาทสัมผัสหลายรูปแบบ ประเมินการเจริญเติบโตทารกโดยการชั่งน้ำหนัก วัดความยาวลำตัว และความยาวของเส้นรอบศีรษะ ประเมินสัมพันธภาพระหว่างมารดากับทารกโดยใช้แบบวัดความรู้สึกรักใคร่ผูกพันของมูลเลอร์ และทดสอบทางสถิติโดยใช้ t-test และ ANCOVA

ผลวิจัยพบว่า เมื่อสิ้นสุดการศึกษาพบว่าทารกในกลุ่มทดลองมีอัตราการเจริญเติบโตสูงกว่าทารกในกลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ ($p<.05$) และมีคะแนนเฉลี่ยความรู้สึกรักใคร่ผูกพันระหว่างมารดากับทารกสูงกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ ($p< .05$)

จากผลการวิจัยสรุปได้ว่า การส่งเสริมปฏิสัมพันธ์ระหว่างมารดากับทารกด้วยโปรแกรมการกระตุ้นประสาทสัมผัสหลายรูปแบบนี้ นอกจากเกิดประโยชน์โดยตรงต่อทารกแล้ว ยังช่วยส่งเสริมสัมพันธภาพระหว่างมารดากับทารกให้แน่นแฟ้นยิ่งขึ้น ดังนั้นจึงควรนำโปรแกรมนี้มาใช้ในการดูแลทารกเกิดก่อนกำหนด โดยส่งเสริมและสนับสนุนให้มารดาปฏิบัติอย่างต่อเนื่องเป็นกิจวัตรในการดูแลทารกตั้งแต่แรกเริ่มที่โรงพยาบาลและหลังจำหน่าย โดยเฉพาะอย่างยิ่งในช่วงเดือนแรกของชีวิต

CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Background and rationale

Birth before full-term gestation markedly increases the risk of prenatal problems in Thailand. Despite technological and medical advances the proportion of premature births has remained unchanged, whereas the number of surviving infants has increased dramatically. The premature infants appear small and underdeveloped; they are often also found to have low birth weight. The percentage of live births in government hospitals that weight 2,500 grams or less at birth were 11.0, 11.1, 12.5 and 13.5 in the years 1994 to 1997 respectively (Ministry of Public Health, 1997). In the record of the Police General Hospital was found 5.8 percent in the last two years, and increasing to 8.5 percent by the year 2000. General immaturity of premature infants can lead to dysfunction in any organ or body system that affects a wide range of problems including respiratory distress, ineffective thermoregulation, hypoglycemia, gastrointestinal dysfunction, hyperbilirubinemia, and infection. The premature infant may also suffer impaired development from the effects of sensory overload and environmental stress as an immature central nervous system compounds this risk. The premature infants at term in comparison with full-term infants show both structural and functional delay in brain development. It is significantly less gray and white matter differentiation and less advanced stage of myelination (Huppi et al., 1996). These premature infants spend a

longer time after delivery to gain weight and grow and ready for discharge than with full-term infants.

Als (1982) described the hierarchical development of premature infants across five subsystems: autonomic, motor, state organization, attention and interaction, and self-regulation. The ability to receive and respond positively to interaction is related to the maturation and functioning of sensory systems. The three commonly identified sources of environmental stress are auditory, visual, and tactile stimulation. Developmental implications of these stimuli are provided based on infant response. There are intervention studies to promote growth and development of premature infants such as tactile and kinesthetic stimulation (Eam-sila, T, et al., 1994; Field et al., 1986; Rausch, 1981; White & Labarba, 1976) auditory stimulation (Katz, 1971; Standley & Moore, 1995) vestibular and auditory stimulation (Kramer & Pierpoint, 1976) auditory, tactile, vestibular, and visual stimulation (Tinikul, S., 2000; White-Traut et al., 1997). These findings have shown to be beneficial for motor activity, neurobehavioral functions, and autonomic stability, but in terms of growth they have been inconclusive. Therefore, further studies of the effects of sensory intervention on growth are needed.

In previous studies, both uni-modal and multi-modal sensory stimulation were used as supplemental intervention for premature infants. In this study the researcher chooses the forms of multi-modal (auditory, tactile, vestibular, and visual stimulation), which were the stimuli characteristics of their intrauterine environment. It was postulated that this was the appropriate method for the infants because of the affirmation that all functions of the nervous system were stimulated at the same time (Feldman & Eidelman, 1998; Glass, 1999). The intervention was also based on data suggesting that it is safe and

is both physiologically and developmentally supportive for premature infants (Tinikul, S., 2000; White-Traut et al., 1988; 1997). The finding of Tinikul (2000) that the stimulated infants have improved on the Brazelton Scale and greater maturational development were identified, and a trend in growth was found. The researcher adopts patterns of sensory stimulation from Tinikul (2000)'s study, which found no harm and no causes of stress to infants. The researcher chooses music as was used in Tinikul's study (2000) had used because it is a universal language and is practical for both mother and the researcher to perform. Using taped music with noise level at 60-65 dB for 10 minutes serves as the auditory stimulus. Tactile stimulation is provided to infants with a stroking direction from head to toe for 2-5 minutes stimulation, before and after vestibular stimulation. The flexing and extension of extremities provide vestibular and kinesthetic stimulation for 5 minutes. Holding the infant in the en face position and talking softly for a minute achieves visual stimulation.

As medical problems, early separation of infants from their mothers caused the loss of opportunity for early interaction in the sensitive period. The observations of Klaus and others (1970) found that after immediate, prolonged separation of the mother from her premature infant following delivery, mothers started with fingertip touch on infants' extremities, massaging, and then palm contact on the trunk. Fear of harming the fragile infants prevents the mother from feeling at ease in touching her infant. The stress of postnatal illness may affect infant's behaviors as well as the mother's behaviors toward the infant. A mother's anxiety in the first few days after birth may affect her relationship with the child long afterward. Prolonged hospitalization has been shown to correlate with poorer maternal-infant relationships, failure to thrive, child abuse or abandonment, and

grieving mothers (Wong, 1999). Thus, demonstrating for mothers and facilitating the development of suitable interaction skills with the infant and mother are essential. The recent studies examined the efficacy of the interventions to enhance the quality of maternal-infant interaction showed that the experimental groups had significantly higher scores of maternal-infant attachment than those in the control groups. The interventions were designed to influence the mother's sensitive responsiveness toward her infant by presenting information about the infant's competence to interact (Lojanawongsagorn, P., 1998), holding the infant skin to skin such as kangaroo care (Numprasert, W., 1996), programming contact and reciprocal interaction (Trisayaluck, T., 1998).

Klaus and Kennell (1982) proposed that care taking is important for psychic closure of the task of bonding. The mother is encouraged to be involved in this program because she is a primary caregiver. They are taught how to intervene, read cues and learn appropriate responses to their infants, and then they are encouraged to give affectionate handling by motivation to be involved and interact with their infants. Because the technique of this program promotes activity interaction between mother and her infant, the researcher expects that this technique will be able to enhance maternal-infant attachment and infant's growth as well. Therefore, the researcher paid special attention to study effects of the multi-modalities sensory stimulation program on the growth of premature infants and maternal-infant attachment.

Theoretical Framework

This research has been carried out based on the synactive theory (Als, 1982) and Klaus and Kennell' s attachment theory (Klaus and Kennell, 1976) to the study of sensory stimulation in premature infants.

The synactive theory of development (Als, 1982) provides a model through which one can specify the degree of differentiation of behavior and the ability of infants to organize and control their behavior. The theory specifies the range of neonatal behavior as the infant matures as well as the ability of the infant to regulate behavior. The premature infants, initially, tend to be unstable and fragile, with sudden changes in their autonomic, motor, and state systems. These infants often have all-or-nothing responses. They may have minimal response to handling or other sensory input until a threshold is reached. Infants are seen as being in continual contact with their environment via five subsystems including the systems of autonomic, motor, state-organization, attention and interaction, and regulatory. This framework assumes that the infant has strategies available to move toward and take in stimuli, if the input is appropriate in timing, complexity, and intensity in relation to the infant's thresholds of functioning. On the other hand, the infant has strategies to move away from inputs that are too complex, intense and inappropriately timed.

Als (1982) also has developed a method of individualized care of the premature infant that takes into account what each infant finds soothing or disruptive during a formal observation. Because the patterns of care can either enhance or interfere with the infant's neurobehavioral organization. These will be enhanced by caregiving that is based on infant cues such as state and self-regulatory and stress behaviors. The theory is also

mentioned in the application of sensory input in aspects of decreasing environmental stimuli. Quiet protected contained time is of great importance. White-Traut and colleagues (1994) suggested that the typical NICU environment could be incompatible with the neuro-developmental needs of premature infants. The two senses least well developed i.e., auditory and visual are the most stimulated ones in the NICU, whereas the better developed senses i.e., tactile and vestibular are the least stimulated. Moreover, most tactile stimulation occurring with procedures is of an unpleasant nature. White-Traut and others had administered a nurturing, multi-modal stimulation program to promote the infants' behavioral organization and integration of sensory function with preterm infants in a series of studies (White-Traut & Goldman, 1988; White-Traut et al., 1993; 1994; 1997; Burns et al., 1994). They found that it is appropriate for infants who have reached 33-34 post-conceptional age and are at high risk for developmental delay and it was not harmful to infants.

Both, Als and White-Traut also have mentioned the maternal involvement that is corresponding to the concept of attachment proposed by Klaus and Kennell (1976). They indicated that prolonged contact between mother and infant was crucial to the formation of an attachment bond, and stated that the most typical is the period immediately after birth; both mother and infant are physiologically and psychologically ready for reciprocal interaction. At birth, all five senses are operational, and the infant is ready to cue and shape the environment. This is the sensitive period in which the attachment process is initiated. But in the premature birth of an infant, with medically indicated interventions necessary to sustain life, the mothers often do not have the psychological time to prepare. Klaus and Kennell also suggested that seeing and touching are the species-specific

behaviors in which humans attach to their young; that the earlier the mother-infant contact after birth, the more facilitated was the mother-infant attachment.

Based on the assumption that infants in the NICU are sensorial deprived and seeks to reduce the negative effects by increasing the infant's sensory experiences. The study of brain development has shown that several areas of the CNS continue to undergo significant changes during the period these infants are in the NICU (Casaer, 1993). This is also a time when fetal behavior becomes more complex, with increased sucking on fingers and hand; grasping, extension, flexion, and rotations of limbs and trunk; increasingly discernible sleeping and waking periods, as well as reactions to sound. During this period, the developing sensitivity and density of receptors for certain neurotransmitters are very much influenced by the nature of experience. Glass (1999) suggested that early sensory input promotes sensory maturation, that early supplemental sensory stimulation for preterm infants should begin with the sense that are the most mature, and should simulate the type of stimulation that is experienced by the fetus in utero.

At this time, if it is medically possible for the mother to touch or hold her infant, she should be offered the opportunity. Especially holding in the en face position instigates the infant to be able to visually follow the mother's face and voice and signal the mother with facial expression, movement, and vocalization. Eye contact may be a positive release of maternal feeling of warmth, closeness, and caring. This way not only facilitates attachment but also provides the mother with an emotional experience that is very sustaining and reassuring, helping them to proceed through a critical time of separation.

The interventions like multi-modalities sensory stimulation with maternal involvement can help not only to promote mother-infant interaction but also to enhance the infant's

neurobehavioral organization and development as well. Also, the infants experience the world through their mothers. A sense of trust is developed. The world will be a good and pleasant place to live for them. On the other hand, the maternal capability to soothe and satisfy the infant will provide emotional satisfaction and positive feedback about the mother's competency.

Sirinat Tinikul (2000) modified the multi-modalities sensory stimulation program provided to premature infants by combining two techniques of Field (Field et al., 1986: 655) and White-Traut (cited in Burns et al., 1994: 583). It had been used on premature infants in the ward for ten days. The results improved on the Brazelton Scale and greater maturational development were identified. The experiment group showed better performance on the Brazelton scale especially in the area of habituation, orientation, motor activity, and a range of state behaviors, autonomic system, and supplementary items, and at the end of the study there was the increased body weight of the stimulated infants. Good performance in sensory stimulation causes well development of infants. The quality of the performance of the stimulation may cause better early attachment by mother-infant interaction, and over a long period it may be reflected in growth patterns. The basic hypothesis is that more confidence would result in an enhanced mother-infant interaction, which would encourage the infant's growth and development in a manner commensurate with that of a full term infant in turn. Therefore in this study, the researcher will do the consecutive work by providing this program with maternal involvement and then follow up at 1 month of age, in which the two themes are interested maternal-infant attachment and the growth of the infant.

Sensory stimulation program provided to the premature infants was as follows:

1. **Auditory stimulation.** It is theorized that music may regulate oxygen intake so well in the newborn and neurologically immature infants that the absence of music caused disruption in the infants' autonomic responses (Standley & Moore, 1995). This method benefits for the development and maturity of the right brain, the intellectual and emotional behavior of infants, and the improvement of general body tonus (Chaze & Ludington-Hoe, 1984:71). Infants will feel relaxed and calm with longer periods of sleep. While sleeping, the metabolism rate and oxygen was decreased, but growth hormones were increased. The increase in growth hormones caused the increase in the infants' weight, feeding quantity, early discharge from hospital, and their gradual development (Cain, 1992 cited by Olson, 1998; Kramer & Pierpont, 1976).

2. **Tactile stimulation.** Tactile stimulation is provided to infants with the belief that touch is the major method of communication (Weiss, 1979). The sense of touch, temperature, and pressure are all well developed, and receptors lie in the infant's skin. Tactile sensation may arouse or make the infant calm and gentle. Firm handling makes infants be quiet because they feel secure, whereas uncertain touch often results in agitation and withdrawal (Korner, 1990). The results of stroking given in a head-to-toe direction over the infant's entire body surface will stimulate reticular formations to increase the somatotrophic hormone output of the hypothalamus which causes the growth of the pituitary gland, the maturing of tissues, the increase of weight and strengthening of muscles (Kuhn, et al., 1991). Also Dieter and Emony (1997 cited by Harrison et al., 2000) suggested that supplemental tactile stimulation may activate the vagus nerve by stimulating peripheral nerves, thereby promoting the release of gastrointestinal hormones, such as gastrin and cholecystokinen which enhance weight gain.

3. **Vestibular and kinesthetic stimulation.** Vestibular and kinesthetic stimulation caused the increase of body movement and muscle tone. The vestibular system develops postnatally and becomes integrated with other sensory modes for controlling postural stability (Haith, 1986). Having received the sensory stimulation, tactile and vestibular/ kinesthetic stimulation, the greater development of myelinization of nerve fibers effecting to the development of memorial capacity of infants had occurred (Chaze & Ludington-Hoe, 1984). The increased motor activity level derived from extra-stimulation, which would lead to greater expenditure of energy and attenuated weight gain by increased metabolic efficiency. Exercise or increased activity is also noted to increase growth hormone release in humans, which may mediate weight gain (Field, 1986; White & Labarba, 1979) and create regular respiration, digestion, and metabolism, and body weight gain.

4. **Visual stimulation.** This technique, which promotes active interaction between mother and her infant was used by adopting from White-Traut's technique (cited in Burns et al., 1994). The human face has been found to be a powerful visual stimulus, especially the talking face that stimulates both visual and auditory pathways (Gardner, et al., 1993:591; Glass, 1999). 8 to 12 inches is recommended as the best distance for the infant to focus (Brazelton, 1999; Oehler, 1993). Visual stimulation is naturally preferential in development of the occipital cortex. The visual pathways will also develop the readiness of the visual receptors, the conjunction of head and eye movement, under the cortically controlled visual system, promotes attention and perception in the ability to learn and in recognition (Brazelton, 1999). These sensory and motor functions are ready to receive stimulation from, and to interact with his or her mother. It is also giving a real

identity or personification to the baby, as well as getting rewarding feedback for the mother.

Both depriving and over-stimulating can modify the developing brain (Glass, 1999: 91) and it is assumed that the optimal sensory stimulation is experienced within the womb. The above four modalities of sensory stimulation were appropriate only for clinically stable premature infants. The intervention will take nerve impulses to the cortical of the brain and produce a fruitfulness of cortical improvement during the period of brain development (Als & Gilkerson, 1997). The benefit of the multi-modalities sensory stimulation program, in addition to the maternal involvement, will promote an affectionate tie between mother and infant. The researcher's aim is to implement the program and also provide an opportunity for maternal involvement of the program, in belief that mother will give tender loving care and attention to her infant and perception of the infant and improvement of the infant's neurobehavioral organization. The outcome of this study will be used for the development and progress of nursing care, and the promotion of growth and maternal-infant attachment as well as stated in figure 1

Research Framework

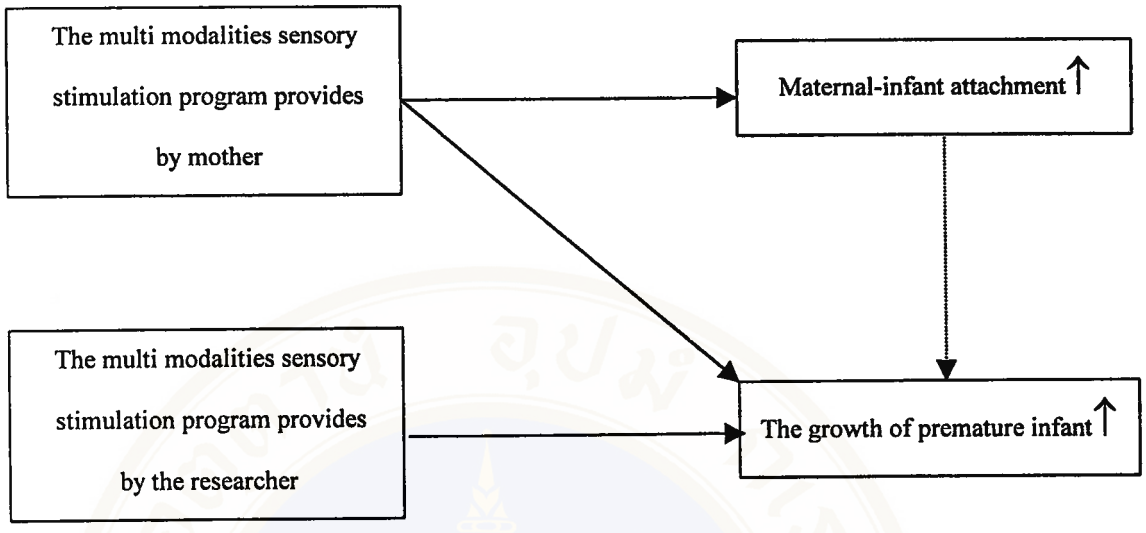


Figure 1 showing the related of variables

Research Objectives

1. To compare the maternal-infant attachment scores between the control and the experimental groups.
2. To compare the growth of the premature infants (body weight, length, and head circumference) between the control and the experimental groups.
3. To compare the growth of infants and maternal infant attachment scores change within group in both groups.

Research questions

What is the effect of the multi-modalities sensory stimulation programs on growth of premature infant and maternal-infant attachment?

Research hypothesis

1. The growth of infant measured by body weight, length and head circumference of the experimental group is higher than the control group at one month after delivery.
2. The maternal-infant attachment scores of the experimental group are higher than the control group at one month after delivery.
3. The growths of infant and maternal infant attachment scores of the experimental group after implementing program are higher than before implementation.

Scope of Research

The purpose of this quasi-experimental research was to study the effects of collaborative role of nurse and mother in providing multi-modalities sensory stimulation program on maternal-infant attachment scores and the growth of premature infants. The sample was mothers of premature infants and their infants who were admitted to a high-risk unit at The Police General Hospital. Forty mother-infant dyads were equally divided into two groups, and were recruited during the period from July 2001 to February 2002.

Expected outcomes and Benefits

1. For nursing service, this research will provide the basis for developing the collaborative role of nurses and mother in promoting the growth of the premature infant and maternal-infant attachment by multi-modalities sensory stimulation program.

2. For nursing instruction, the nursing instructor can use the research findings to teach nursing students about the effect of collaborative role of nurses and mother in multi-modalities sensory stimulation program for enhancing interaction between a mother and her infant.
3. For nursing research, it may provide indications for further related research on other groups.

Assumption

The premature infants need appropriate sensory stimulation. The multi-modalities sensory stimulation intervention has been proved to be safe and beneficial for stable premature infants who are 32 weeks gestational age or older. Therefore, the appropriate intervention should be conducted by nurses as well as maternal involvement during the infant's hospitalization and continued to the home setting after discharge by their mother.

Definition of Variables

Multi-modalities sensory stimulation program means the 16 minute stimulation sessions consisting of three standardized phases: 1) auditory, tactile, and vestibular/ kinesthetic stimulation for 10 minutes, 2) re-provide tactile stimulation for 5 minutes, and 3) visual stimulation for 1 minutes. This program was modified from the sensory stimulation program of White-Traut and colleagues (cited in Burns et. al, 1994) and Field and colleagues (1986) by Tinikul (2000). The intervention was daily provides to

the clinically stable infant every day. The mother will stimulate the infant four times per week or more, and, the researcher stimulated the infant on other days.

Maternal-infant attachment means the affectionate tie between the mother and her infant, which develops gradually and persists over time. It is measured by the Maternal Attachment Inventory (MAI) (Muller, 1994), which contains 26 items with a 4-point scale of the response set. For score calculations, all items were summed up for a total score. The higher the score, the higher the maternal affectionate attachment is to the infant. The possible range of scores was 26-104.

Growth means an increase in physical dimensions such as, bodyweight, body length (height), and head circumference. The researcher measures at the first day of life and the end of the study, at one month old.

Body weight means the weight of the infant without clothes, to be measured by using the infant's bodyweight scale in grams

Body length means the length of the infant, to be measured in centimeters by placing a tape from the top of the head to the base of the heels.

Head circumference means the length that is measured above the eyebrows and pinna of the ears and around the occipital prominence at the back of the skull, measuring by the metric system with centimeters.

CHAPTER II

LITERATURE REVIEW

In this study, the review of related literature covered the following topics: Premature infants and characteristics, growth of premature infants, sensory stimulation program, and maternal-infant attachment

The premature infants and characteristics

Premature infant is defined as a live-born infant that is born before completion of 37 weeks of gestation, regardless of birth weight (Behrman et al., 2000; Siripoonya, P., 1993; Wong, 1999), because intrauterine growth rates are not the same for all infants.

There are 3 groups of premature infants classified according to birth weight those are the following:

1. Low birth weight infant (LBW) means infant whose birth weight is less than 2,500 g
2. Very low birth weight (VLBW) means infant whose birth weight is less than 1,500 g
3. Extremely low birth weight (ELBW) means infant whose birth weight is less than 1,000 g

Characteristics of premature infants

The characteristics of each premature infant vary with the gestational age. There are the most marked in the infant with shortest gestational age and become less distinctive as the gestational age increases. The method frequently used for determining gestational age is the Simplified Assessment of Gestational Age by Ballard. This method is scoring by assessing six external physical and six neuromuscular signs. Each sign has a number score, and the cumulative score correlates with a maturity rating from 20 to 44 weeks of gestation (Wong, 1999: 310).

The characteristics of premature infants are as follows: (Pillitteri, 1999: 142; Siripoonya, P., 1993: 66; Wong, 1999: 431).

1. Infant has a large head in proportion to the size of its body. It is 3 centimeters or greater than chest size.
2. Because of weakness of muscles, preterm infants are inactive. The extremities maintain an attitude of extension and remain in any position in which they are placed.
3. The skin is bright pink, often translucent, smooth, and shiny, with small blood vessels clearly visible underneath the thin epidermis.
4. The fine lanugo hair is abundant, covering the back, forearms, forehead, and side of the face.
5. The preterm neonate, 24 to 36 weeks, typically is covered with vernix caseosa.
6. The sole of the foot of the premature infant has very few or no creases. With the increasing gestational age, the number and depth of sole creases multiply.

7. In infants younger than 34 weeks' gestation the areola and nipple are barely visible. After 34 weeks the areola becomes raised.

8. The ear cartilage is soft and pliable, and begins to appear at approximately 32 weeks so that the ear returns slowly to its original position.

9. Regarding genitalia, in the premature male the testes are very high in the inguinal canal and there are very few rugae on the scrotum.

   In female, the clitoris is very prominent and the labia majora are very small and widely separated

10. A pliable thorax, immature lung tissue, and immature regulatory center lead to periodic breathing, hypoventilation, and frequent period of apnea. The development of the lungs depend on the length of gestation.

11. Poor control of body temperature because of the poor heat production and increased heat loss that relatively greater body surface and the lack of subcutaneous fat, particularly brown fat.

12. Sucking and swallowing activities are coordinated approximately 32 to 34 weeks of gestation, and fully synchronized at 36 to 37 weeks.

13. Anemia, hypoglycemia, and hypocalcaemia may occur afterward because of the limitation of its storage.

14. The liver is relatively large but its function is poorly developed. That immaturity predisposes to jaundice by reason of its inability to conjugate and excrete bilirubin.

15. Improper elimination of body wastes contributes to electrolyte imbalance and disturbed acid-base relationships. Dehydration occurs easily, tolerance to salt is limited and susceptibility to edema is increased.

The infant's functioning is seen in a model of continuous intra-organism, subsystem interaction and the organism, in turn, is seen in continuous interaction with the environment. Als (1982) explained the infant's efforts at self-regulation through approach and avoidance behaviors. From 24-27 weeks post conceptional age, the fetus can be kept alive in an extra-uterine environment due to the advances of medical technology. The infant is biologically expecting 13-16 more weeks of in utero existence, with respiratory, cardiac, digestive, and temperature control aided by the maternal blood flow and placental functioning. Kinesthetic input from the contingently reactive amniotic sac, prevents full extensor patterns and assures flexor inhibition and maintenance for the typical head-trunk extremity adjustments and movements of soft modulated limbs, trunk, and head movement. The infant is expecting presumably that sensory input to the primary senses of vision and audition, readying him/ her for the experience of the extra-uterine world. The premature infant is a well equipped, competently adapted organism appropriately functioning at his/ her stage and in a particular environment. Suddenly, the infant is in a vastly different environment, the passage to which has irreversibly triggered subsystem functioning in an environment only poorly matched to the infant's expectations. The motor system, the state-organizational system and sensory functioning intimately dependent on an adaptive environment are largely left to their own devices. The autonomic functioning is currently the primary focus of medical care. The freeing up of

the strands of the next developmental agenda in the offering must occur on the background of well integrated functioning in order to set and maintain the path of development in a positive direction. Self-regulatory balance is reflected by the presence of regular respiration, pink color, a stable visceral system, smooth movements, modulated tone and softly flexed posture, and steady sleeping and waking states. As a general rule, extension behaviors are thought to reflect stress, and flexion behaviors are thought to reflect self-regulatory competence. Diffuse behaviors are thought to reflect stress and well-defined behaviors are thought to reflect regulatory balance.

Growth of premature infants

Growth implies a change in quantity. An increase in the number and size of cells as they divide and synthesize new proteins results in increased size and weight of the whole or any of its parts. Growth proceeds in regular, related directions or gradients and reflects the physical development and maturation of neuromuscular functions (Wong, 1999: 119). The first pattern is growth in the cephalocaudal, or head-to-tail, direction. The head end of the organism develops first and is very large and complex, whereas the lower end is small and simple and takes shape at a later period. The second pattern is growth in the proximodistal, or near-to-far, direction. These patterns are bilateral and appear symmetrical on both sides, develop in the same direction and at the same rate in the infant. The third trend in direction growth and differentiation describes development from simple operations to more complex activities and functions.

The growth of premature infants depends on gestational age, birth weight, duration and severity of neonatal illness (Dusick, 1997; Manser, 1984; Marks, 1986).

Premature infants may show reduced growth as a result of central nervous system injuries or deficiencies, sub-optimal nutrition, and low birth weight from intrauterine growth retardation (Babson et al., 1980). Manser (1984:22), in reviewing the literature describing growth in high-risk infants, clearly demonstrated characteristic growth phases as follows:

Phase I Growth delay This phase follows birth and corresponds to the sick. Initial dynamic changes occur in body water and electrolyte distributions that are reflected by decreasing in weight and head circumference. Growth delay is directly correlated with the degree of nutritional restriction. Waterston and others (1997) stated that the main influences on growth in fetal and early postnatal are nutritional and hormonal factors. Supported by the study of Ehrenkranz and colleagues (1999), they found more rapid weight gain was associated with a shorter duration of parenteral nutrition providing, an earlier age at the initiation of enteral feeding, and an earlier age at achievement of full enteral feeding.

Phase II Transition Emphasis is placed on the achievement of fluid and electrolyte homeostasis, improvement of the infant's medical status, and maintenance of his caloric intake. At the point when caloric intake exceeds the infant's need for maintenance, and catabolic needs from disease states diminish, slow growth begins, initiated by head growth paralleled by increases in length. As Dusick (1997: 169) mentioned, unless there is severity of neonatal illness, premature infants born between 27 and 33 weeks of age will show their most rapid catch-up growth between 36 and 44 weeks. Yet in the case of severe neonatal illness, up to 46% of VLBW infants can fail to grow adequately in the neonate period.

Phase III catch-up growth The third phase of growth is characterized by an increase in head circumference, length, and weight. Nutritional restriction has been shown also to limit the velocity of catch-up growth. Infants delivered following intrauterine growth retardation demonstrated catch-up growth at 6-9 month of age. According to the work of Babson (1970, cited by Babson et al., 1980) demonstrated growth in three groups of low birth weight infants (A: very premature, B: moderately premature, and C: term with severely under-grown) corrected for gestational age. By the age of 6 months most of the readjustment from undergrowth has occurred, and from this time on most infants will follow their established channels of growth.

Phase IV Homeorrhesis This phase is characterized by patterns that closely parallel the growth in standard growth charts. The growth rate of premature infants with prolonged growth delay, the slowest catch-up growth will be in the lowest percentiles or below standard growth charts (Dusick, 1997). These infants appear to be at the highest risk of subsequent neurodevelopment handicap.

The basic parameters for growth assessment of premature infants are daily measurement of weights, twice-weekly head circumference, and weekly length (Fletcher, 1998: 39). Gairdner and Pearson (1971) have designed a growth chart for premature infants. It covers the period from 28 weeks of fetal life to the age of 2 years with the logarithmic time scale that provides the convenience of an extended scale for the earlier month of life. However, standard infant growth charts may be used, by correcting for prematurity when plotting growth parameters (Needman, 1996). This correction should continue until 18 months of age for head circumference, 24 months for weight, and 40

months for length.

In the study of Tanner and Thomson (1970, cited by Gairdner & Pearson, 1971), the daily weight gain of the average (male) fetus over the last two months of gestation, is 36 g./day between 32 and 36 weeks, falling to 25 g./day between 36 and 38 weeks, and then to 14 g./day between 38 and 40 weeks. Babson and others (1980: 293) indicated that after birth, this decline in the growth rate was as follows:

Body weight By 4 to 6 day of age, birth weight loss averages 10% to 15% for all weight groups, and is regained in 1 to 3 weeks depending on maturity and nutritional intake.

Body length Growth at the fetal rate is resumed by about the third week of life, an average increase of more than 1 centimeter in each week. By 40 weeks the very premature infant can be as much as 3 to 5 centimeters shorter than an infant born at term.

Head circumference. During the first few days of life, infant's head will decrease approximately 0.5 centimeters in circumference, with an accompanying overlapping of the sagital suture. The later weekly increment of growth increase is often as much as 0.9 to 1.1 centimeters. During the first 3 months of life, an average increase in each week is 0.5 centimeter.

A factor believed to affect premature infant weight change in the early postnatal period includes caloric intake, gestational and chronological age, Apgar score, gender and race. The study of Nelson and Heitman (1986), which the data was submitted to a

multiple regression analysis, revealed that the chronological age was the major factor accounting for the largest portion of explained variance, which implies that weight gain in the premature infant is affect by **age.** The investigation by Singhi and Singh (1979, cited in Nelson & Heitman, 1986) showed that in premature infants, initial weight loss usually extended over 6 days as opposed to 2 days in full term infants. The second factor was **milliliters of formula** consumed, which indicated that premature infants consuming more formula would show greater weight gains. The optimal gains occurred when intakes were between 80 and 110 calories/ kilogram/ day (Singhi & Singh 1979, cited in Nelson & Heitman, 1986). The third factor was **birth weight .** Birth weight significance may be attributed to the percentage of body fat and muscle tone, which helps to maintain infant's body temperature, thus reducing the incidence of hypoglycemia and hypothermia. The final significant variable involved was the **Apgar score** at 5 minutes. The study by Goldenberg and others (1984, cited in Nelson & Heitman, 1986) provided a possible rationale for this significant relationship that with increasing gestational age associated with an Apgar score of less than 7, the incidence of asphyxia increase, resulting in a decreased weight rate.

Maternal-infant attachment

The terms attachment and bonding are used to describe the process of relating between mother and her infant in the work of Klaus and Kennell (1976). As they have described, "Attachment is crucial to the survival and development of the infant. The mother's attachment to her child is the strongest bond in the human, which has two unique characteristics. First, before birth the infant gestates within the mother's body, and,

second, after birth she ensures his survival while he is utterly dependent on her" (Klaus & Kennell, 1976:1). They expressed the crucial component in the process of the mother's attachment to her infant (Klaus & Kennell, 1976:14) are as follows:

1. For optimal bonding, it is necessary that the mother has close contact with her neonate in the sensitive period.
2. The first time the mother is given her infant, there are the species-specific behavior responses to the infant in the human mother.
3. The process of the attachment is structured so that the mother will become attached optimally to only one infant at a time.
4. It is necessary that the infant respond to the mother by some signal such as body or eye movements during the process.
5. The birth process makes the witness come to be strongly attached to the infant.
6. It is difficult to develop an attachment to one person while mourning the loss or threatened loss of the same or another person.
7. Anxieties about the well being of a baby with a temporary disorder in the first day may result in long-lasting concerns that may cast long shadows and adversely shape the development of the child.

Using the developmental principles of readiness, sustained and early parent-infant contact completes the process of labor and birth and gives time for the family for interaction. Klaus and Kennell have described the interactions originating in the mother that affect the infant as follows:

Touch They believed that the most important behavioral system that serves to bind mother and infant together is the mother's interest in touching her baby. By observing when the nude infants were placed next to their mothers a few minutes after birth, most mothers touched them in a pattern of behavior that began fingertip touching of the infant's extremities, massaging, stroking, and encompassing palm contact with the trunk. In the study on the first three contacts, mothers of premature infants showed fingertip contact increased in the second and third contacts (Klaus et al., 1970). Comparing ranking of touch categories by gestational age was significant: young infants received more contact actions and had shorter duration of touch and fewer touch episodes than did older infants (Harrison, 1991).

Eye-to-eye contact Another interaction that proceeds from mother to child originates in the eyes. Brazelton (cited in Klaus & Kennell, 1976: 70) provided commentary in this topic that eye-to-eye contact serves the purpose of giving a real identity or personification to the baby, as well as getting rewarding feedback to the mother. In the work of Klaus and associates (1970), once the infant looked at the mother , the mother felt much closer to the infant. The en face position enables the mother and the infant to look directly into each other's eyes.

High-pitched voice The study has shown, and observation of them found that the neonate alerts and attends to the female voice of mother, then, fits with the infant's sensitive auditory perception and his attraction to speech in high frequency range. Psychological research has shown that infants prefer the mother's voice to all other auditory stimuli during the first few days of life (DeCasper & Fifer, 1980). The value of human voice is deeply soothing as an instinctive from of caring. (Kirby, 2000). These

opportunities nourish the infants and enable them to orientate themselves to the world and particularly to their parents.

Entrainment. Klaus and Kennell believed the organization of the neonate's motor behavior is entrained and synchronized with the organized speech behavior of the adult in his environment. The infant moves in rhythm to his mother's voice, on the other hand that may reward the mother and stimulate her to continue this activity. This synchrony becomes the important ambiance for their affective communication thereafter.

Time giver. The disruption of birth upsets the baby's prior rhythms and throws his systems into a state of disequilibrium. He must reorganize the biorhythmically of his states and behavior to fit his extrauterine environment. The high occurrence of the alert state results from the interaction of a sensitive mother with her infant. When he is alert, he is ready to respond to the mother, to dance in rhythm to her speech or movements. Tactile contact and vestibular stimulation are essential. The mother may be encouraged to hold her nude baby against her bare chest. Skin to skin contact on the mother's chest enables the premature infant to experience by the tactile, auditory, proprioceptive, and rhythmically channels the mother's heart beat, the rhythmic flow in the major blood vessels, and the touch of a human skin while being contained (Feldman & Eidelman, 1998). This is also indicated by APGAR score (Letko,1996).

T and B-lymphocytes, macrophages Breast milk is a rich source of antibodies, particularly in colostrums that there are high concentrations of IgA and T and B-lymphocytes. The mother can provide protection against the enteric pathogen for which the baby receives little transplacental protection throughout breast-feeding.

Bacterial nasal flora Mother and baby who are kept together in the first minutes of life, the mother gives her baby her own mixture of strains of respiratory organism, such as the staphylococcus, which then grow and populate the infant's respiratory and gastrointestinal tract. These organisms may prevent the baby from acquiring the hospital strains of staphylococci.

Odor The odor of the mother can also affect the infant. By the fifth day of life of the breastfeeding infant the investigator found that infants could discriminate their mother's own breast pad from of the other with significant reliability. They turn their heads toward their own mothers' breast pad (MacFarlane, 1975 cited by Klaus & Kennell, 1982). In the NICU, the high-risk infant is stimulated by the noxious odor such as alcohol, povidine-iodine. Enhancing the olfactory environment includes having mother hold the infant or sat close if the infant cannot be held. Placing one drop of breast milk on the infant's lip helped him to recognize the mother's smell and to associate smell of feeding (Gardner, 1993).

Heat The body of the human mother was a reliable source of heat for the infant. The study had found a minimal drop in the infant's temperature when the baby was placed on the mother's chest wrapped and without a heat lamp. Another method supportive of maternal caregiving was kangaroo care, in which the good condition infant is placed on the mother chest for skin-to-skin contact to maintain warmth and provide tactile stimulation. This technique fosters mother-infant relationships by promoting mother's confidence in her ability to nurture the fragile infant (Higly & Miller, 1996).

Klaus & Kennell (1976) focused on the concept of a sensitive period that occurs in the first minutes and hours after birth. During this period the mother is more receptive

to bonding with her newborn and that facilitates the attachment process. They believed that prolonged contact between mother and infant immediately was crucial to the formation of an attachment bond. They recommended policy in support of mothers' rooming-in and breastfeeding in premature nurseries. In accordance with that, the study had found mothers who provide breast milk to their babies have a stronger tendency for breastfeeding and then maintain the practice for a long time (Chewwattana, W, 1994). After kangaroo care, mothers felt stronger attachment to the infant and increased maternal confidence in caring for the infant (Numprasert, W., 1996).

Goulet and others (1998) had attributed a concept analysis of parent-infant attachment and indicated that attachment is frequently confused with feelings of love, instinct, engrossment, and being connected to others. A loving relationship between mothers and their infants is postulated to promote emotional well-being of the infant and mother. They expressed that the attributes of mother-infant attachment include proximity, reciprocity, and commitment.

Proximity means the physical and psychological experience of the mother being close to infant. That attribute comprises three dimensions that are: 1st, contact, the sensory experiences of touching, holding, and gazing at the infant. 2nd, emotional state, which is emerges from the affective experience of the new mother toward her infant and her maternal role. And 3rd, individualization, the mother is also aware of the need to differentiate the infant's needs from herself, to recognize and respond appropriately, making the attachment experience also.

Reciprocity is the process by which the capabilities and behavioral characteristics of the infant elicit maternal response. Mother, who is sensitive and responsive to her infant's cues, will promote his growth and development. The infant, the other one in this interaction process, and his ability to reinforce the mother's caregiving efforts contributes to the quality of the exchanges that take place.

Commitment refers to the enduring nature of the attachment relationship. Mother acknowledges her responsibility for the well-being of her infant and promotes its safety, growth, and development. In addition to the ability of the mother to find her own way, it integrates the maternal identity into her.

The application of touch and mother-infant contact is based on the maternal separation research and attachment theories that emphasize mother-infant contact as central to the infant's physical and emotional growth. Mother-infant contact helps regulate the infant's attention during the en-face position, and improves the infant's information processing in an auditory-visual exercise that affects the infant state and communicative behavior.

The multi-modalities sensory stimulation program

Most preterm infants are related to the state of physiologic and anatomic immaturity of the various organs and systems. With advances in medical technology, effective management and nursing care, many premature infants have successful adjustment to the extrauterine. Infants in the NICU are subjected to inappropriate stimulation, aversive procedures, excessive handling, constant noise, and bright light,

which disrupt the sleep pattern. This may result in hypoxic insults, which can lead to damaging effects on the vulnerable premature infant's brain. It is therefore crucial to minimize environments that are stressful to the mother and infant, in order to implement appropriate intervention strategies. The study found that both over-stimulation and sensory deprivation could modify the developing brain. The study found that premature infants at 40 weeks gestational age compared with full term infants showed both structural and the functional delay in brain development. The structural and the functional delay in brain development caused a difference in myelination of white and gray matter in the brain and in metabolic activity in the infant (Huppi et. al., 1996). The study of Gottlieb (1971, 1976, cited by Korner, 1990: 175) found that genes give rise to structural maturation process, but sensory stimulation enhances the function maturity of the nerve system. That function or experience has not only a maintenance role but also a facilitative and inductive influence on early neural maturation and behavioral development. The rate of maturation of each sensory system varies, as the following series: tactile, vestibular, auditory, and visual. These sensory systems also are interrelated in a hierarchical stimulation of early maturing senses (e.g., tactile, vestibular) that has a positive influence on development of later maturation of sensory systems (e.g., visual) (Turkewitz & Kenny, 1985 cited by Glass, 1999).

It is postulated that individualizing care based on the infant's cues has the potential not only to avoid behavioral and physiological disorganization but also to enhance the normal development of the infant's physiological, motor, state, self-regulatory and interaction systems (Als, 1982). Many studies found that the organization of sensory stimulation by providing a similar environment as premature infants received

when they were a fetus is the best and the most effective method for promotion and well functioning of those five subsystems to mature as full term infants. Improved functioning for treated infants has been noted on immediate and short-term physiological measures, such as reduced number of apnea events, improved oxygenation, faster weight gain, earlier discharge, and neurobehavioral development such as improved motor maturity, orientation, and state organization (Burns et al., 1994; Chaze & Ludington-Hoe, 1984; Eam-sila, T., et al.,1994; Field et al., 1986; Korner, 1990; Tinikul, S, 2000; White-Traut et al., 1993; 1997). Infants will have positive interaction when they receive appropriate stimulation such as this multi-modalities sensory stimulation program.

Auditory sensory stimulation

Development of the auditory system begins around 3 to 6 weeks gestation. The major structures of the ear are essentially in place by 25 weeks of gestation. A blink response to vibro-acoustic stimulation has been obtained in human fetuses of 24 to 25 weeks of gestational age. The more complex behavioral response to sound occurs by at least 28 weeks, but readily fatigues (Glass, 1999:95). The auditory environment in the womb likely provides the most appropriate substrate for normal development of the sensory system. The fluid filled womb would alter the conductive property of the middle ear. Data is unavailable that fetal hearing is limited to bone conduction.

Ambient noise levels in the NICU are reported to range from 45 to 104 dB, and, are generated by routine patient care activities (Gardner et al., 1993). Sound and noise level in the NICU are concerned with two reasons (Thomas, 1989 cited by Blackburn & VandenBurg, 1993): potential damage to the cochlea with hearing loss; and, too arousal. Arousal is a particular concern with immature infants who are unable to inhibit responses.

Zahr and Balian (1995) studied the effects of routine nursing procedures and loud noise on the behavioral and physiological responses of premature infants in the NICU. The infants were between 23 and 37 weeks gestation, and ranged in weight from 480 g. to 1930 g. Both noise and nursing interventions resulted in clinically important changes in physiological measures. Noise alone caused acute drops in SaO_2, an acute rise in heart rates, and acute rise in respiration rates in fourteen, sixteen, and thirteen percent of infants respectively. Seventy- eight percent of infants changed from regular or irregular sleep to fussy and crying states and forty-three percent of infants changed from the sleep state to the fussing/crying state.

The intervention should be aimed at supporting extrauterine life, to reduce ambient noise, and to induce patterned auditory input. Objectives of auditory stimulation aim for relaxation, calmness, and sufficient rest of infant. Many procedures of auditory stimulation such as voices of parents and nurses, lullabies, classical songs and music can be done without limitation, but be aware about the level of sound causing stress to infants. Auditory stimulation, as a single modality, has been reported in the form of a heartbeat, lengthened the duration of the first quiet sleep period. The quiet sleep is a more stabilized state that reflects central nervous system maturity (Glass, 1999).

Many studies are responsible for a growing acceptance of music as a therapeutic modality. In the reviewed literature of Cook (1981), as well as Alvin (1978) stated that music had been used as a means of non-verbal communication with people whose power of oral communication had broken down mentally, physically, or emotionally. Among music's physiologic effects, pitch acts upon the automatic nervous system, with high pitch creating tension and low pitch causing relaxation. In the laboratory observations of

children and adults, Jones and Schlotter (1957), and Dickinson (1958) found music useful to generate calmness, soothing variety, and to decrease anxiety. Meter (1975) found that soothing music decreased minute oxygen assumption and basal metabolism rates, concluding that it would be helpful in clinical situations where anxiety reduction was desired.

Chaze and Ludington-Hoe (1984) stated that the parents' voice stimulated the function of the left hemisphere of the brain on skill and language of the infants, while music stimulated the work of right hemisphere of the brain on intellectual and emotional behavior of infants. Moreover, calling infant by name enhanced recognition of self, and captured their attention. Standley and Moore, (1995) studied the effects of music and the mother's voice on premature infants during a period of 3 consecutive days, by using a convenient sample of 20 oxygenated infants. The study used an experimental/controlled group. 10 participants listened to music and 10 listened to a recording of their mother's voice. On day 1, the music groups stabilized and significantly increased oxygen saturation levels. On days 2 and 3, there were no significant differences between groups during auditory stimulation. While, Caine's study (1992 cited by Standley & Moore, 1995) demonstrated the benefits of long-term stimulation with music in shortening the length of hospitalization of NICU infants. The music was played for a total of one and one-half hour's daily (30 minutes on/ 30 minutes off across 3 hours) from time in isolette to discharge. No negative effect was noted. The work of Collins and Kuck (1991 cited by Standley & Moore, 1995) reported playing music and intrauterine sounds for 10 minutes for infants as young as 24 weeks gestation and reported only positive oxygen saturation results for this very short-term intervention.

In this study, the researcher prefers to use taped music with the noise level at 60-65 dB. Based on the belief that music is the universal language which is good for feeling expression, and not only stimulates the central nervous system of premature infants, but also controls the autonomic nervous system as the previous study had reported (Cook, 1981).

Tactile sensory stimulation

The cutaneous system includes the sensations of pressure, pain, and temperature. The cortical pathway is intact by 20 to 24 weeks of gestation, and some myelin is already present (Glass, 1999: 92). After premature birth, tactile input is radically altered. Handling occurs more often among the sickest infants, typically related to procedures, it is generally is disturbing, and often painful. The amount and type of handling may have direct detrimental consequence for the vulnerable neonate, with each handling averaging 2 to 5 minutes and occurring ever 18 to 30 minutes (Yecco, 1993).

Harrison and Woods (1991) found wide variability in the types and amounts of touch provided by a mother to her preterm infants, but stroking was one of the most common types of touch that mothers used. There was more variability in heart rate and oxygen saturation levels during the stroking period compared to base line. Previous researches have shown that premature infants, particularly younger than 31 weeks of gestation, are often at risk of hypoxia following tactile stimulation. It associates with medical or nursing procedures, the mother visits to the NICU, or tactile stimulation (Harrison & Woods, 1993; Legault, 1995; Ludington-Hoe et al., 1999; White-Traut et al., 1997). However, in a recent finding, Harrison and others (2000) expressed that the physiological and behavioral effects of a gentle human touch has no difference between

two groups, that is it had soothing effect on the infants, promoting comfort, and reducing stress. In psychological aspect, Adamson (1993) stated that a child, who is touched in a sensitive, loving manner feels secure and confident, becomes independent without the need to cling for support. Also, Heinl, a psychiatrist, psychotherapist (1988 cited by Adamson, 1993) has stated that adults who have experienced ample loving touch in infancy develop a strong sense of their identity and self-worth and are more able to withstand emotional trauma.

Weiss (1979) had described the language of touch with six tactile symbols as its components . The symbols should be considered qualitatively as they relate to facilitating adaptation or fostering maladaptation, which is determined by the varying afferent impressions on an individual's skin.

Duration of touch refers to length of time in touching from initiation of the contact to cessation. Preterm infants may not tolerate a long duration of touching. The length of duration should depend on the infant's response, signals, and the developmental maturity.

Location of touch refers to the areas of the body contacted. There are three components in location of touch: threshold; extend; and centripetality. Different parts of the body carry different sensitivity and socio-cultural meaning.

Action is the rate of approach to a body surface with the attendant amount of physical energy. Action can be abrupt or gradual as a function of speed or rate of approach to the body. In practice, preterm infants usually need gradual, and rhythmic action of touch.

Intensity refers to the extent of indentation applied to the body surface by the pressure of touch. Different degrees of intensity in a touch can result in different states of hyperexcitability in the cortex.

Frequency of touch refers to the overall amount of touching person experiences in every day life. Frequency of touch can stabilize relationships and facilitate interactions between individuals and may correlate with self-actualization.

Sensation refers to the immediate comfort or discomfort reaction of the skin to touch, with specialized reception and transmission to the brain. It defines the tactile stimulation as pleasurable or painful to the body surface.

The conclusion is that the perception and response of infants to tactile stimulation is based on the ability of the skin sensation and central nervous system of each. Touching at the areas with afferent sensory fibers should be better and will produce better perception, and that tactile stimulation is the most important stimulation for the growth and development of premature infants. The researcher in this study chooses the pattern of Field and associate (1986) because it is easy and practical. The details will be mentioned on chapter III.

Vestibular sensory stimulation

The vestibular system responds to movement as well as directional changes in gravity and is situated in the non-auditory maze of the inner ear. Vestibular stimulation affects the level of alertness. Slow, rhythmic, continuous movement induces sleep. Periodic or higher amplitude swing increases arousal. The three semicircular canals begin

to form before 8 weeks of gestation, reaching morphologic maturing by 14 weeks and full size by week 20 (Glass, 1999: 95). Response to vestibular stimulation has been observed at 25 weeks of gestation.

The infant is held and movement is slow from maternal breathing and shifting. The change of position is gradual. Vestibular stimulation is used to affect state moving to upright or lying down and increases arousal; monotonous side-to-side rocking and walking in the form of maternal pacing reduces the level of arousal. Vestibular stimulation after preterm birth is limited to efficient manipulation or turning of the neonate by the caregiver. Spontaneous limb movement is generally diffuse, often unrestricted, and typically disorganizing in its effect. In a study related to vestibular proprioceptive stimulation of preterm infants, Kramer and Pierpont (1976) provided a session in a mechanical rocking waterbed one hour prior to each feeding, and playing of a tape of a woman's voice during the rocking period. The mean gestational age was 32 weeks. The results showed that the stimulated groups had greater weight gain, head circumference, better breast-feeding and were more active than the control group. Both groups demonstrated similar maturation in neurological and behavioral features when assessed weekly by using either the Dubowitz method or the Brazelton neonatal assessment scale. For the reduction of apnea in prematurity, the investigators suggested that maintaining the current functioning of the vestibular system may require the initiation at birth of continuous or intermittent vestibular stimulation such as rocking beds or water beds for infants younger than 34 weeks' gestation (Korner, 1990; White-Traut et al., 1994).

Studying the effects of tactile and kinesthetic stimulation on premature infants of Rausch (1981), Field and her colleagues (1986), the treatment was given of gentle rubbing/ stroking and passive flexion/ extension movement of the limbs for 15 minutes each day for 10 days. The results revealed that the treated infants showed greater weight gain (Rausch, 1981) and high score on the Brazelton scale and a shorter hospital stay than that of the control group (Field et al., 1986).

From the supporting data, there are many patterns of vestibular proprioceptive such as placing infants on a waterbed, changing position, flexion and extension of extremities, knee and hips. These help regulate respiratory function and development, enhance development of motoric skills, reflex and postural tone (Gardner et al., 1993). Exercising increases myelination and muscle growth and control (Chaze & Ludington-Hoe, 1984). It is also clear that vestibular and kinesthetic stimulation is the most important stimulation to premature infants.

In this study, the researcher uses the pattern that provides flexion and extension of the limb as Field and colleagues (1986) had used, because of the facility of technique for maternal involvement (Rausch, 1981; Field et al., 1986; Tinikul, S., 2000).

Visual sensory stimulation

Optic, neurological, and behavioral components of the visual system are functional before birth, but significant development occurs postnatally. By 24 weeks of gestation, gross anatomic structures are in place and the visual pathway is complete. The visual system undergoes extensive maturation and differentiation between 24 and 40 weeks of gestation. Visual attention has been documented between 30 and 32 weeks gestation. Premature infants fixate on simple patterns by 30 weeks, and demonstrate

pattern preference by 31 to 32 weeks' gestation (Blackburn & VandenBerg, 1993: 1108). By 36 weeks, the visually evoked response resembles that of a full-term infant (Glass, 1999:102). Vision is the last of the senses to develop anatomically, achieving functional states only as the fetus approaches the last trimester (Munsinger, 1970 cited by White-Traut et al., 1994).

Light levels that are commonly above that recommended for normal newborn nurseries may contribute to retinopathy in prematurity. Glass and associates found an increased incidence associated with a median light level at 60 foot-candles as compared to an infant receiving 25 foot-candles lighting (Glass et al., 1985 cited by Yecco, 1993). The study stated that constant ambient light levels and frequent handlings may interfere with alterations in endocrine function, changes in biologic rhythms, and sleep deprivation (Gray et al., 1998; Oehler, 1993; White-Traut et al., 1994). The resulting deleterious effects on the infant may include a decrease in oxygen saturation, an increase in heart rates, increase in respiratory rates, and caloric intake loss. All of these are linked to alterations in growth outcomes (Yecco, 1993). The study suggests that optimal sleep-wake patterns are produced by reduced light levels, and undisturbed rest period (Blackburn & VandenBerg, 1993).

The study of Haith (1986) mentioned the quality of visual information that is transmitted from the retina to the brain depends on the sharpness of the image that strikes the retina. The eyes can be optimally focus at only one distance at a time. It is believed that the very young infant could not accommodate to varying distances and the lens was fixed to focus only on objects about 8 inches away. The capabability of visual fixing and following during alert periods may be a sensitive predictor of neurological and visual

integrity. In response to an interesting visual stimulus, infants stop sucking to look, become alert, attempt to focus on the object, horizontally scan the object, and fix and follow a moving object in a 90-degree arc. They prefer the human face as a visual stimulus, and pay attention longer to larger patterns with more complex patterns and angles (Brazelton, 1999; Fantz et al., 1975 cited by Gardner et al., 1993).

In the past, visual stimulation was one of the most important stimulations for premature infants; the studies were always conducted with other stimulation such as tactile, vestibular, and auditory stimulation. Having received such stimulation, infants have much more attention and interest. Thus, in this study, the researcher prefers the en face position range 8-12 inch, for 1-2 minutes.

Multi-modalities sensory stimulation has been found to be beneficial for premature infants in terms of growth, motor activity, neurobehavioral functions, and autonomic stability (Burns et al., 1994; Tinikul, S, 2000; White-Traut et al., 1993; 1997). That intervention is provided based on two progressive perspectives: behavioral organization and behavioral interaction.

Behavioral organization is the infant's ability to establish integrated functioning between the infant's physiologic and behavioral systems. The physiologic systems include autonomic functions such as heart rate, respiratory patterns, oxygen saturation levels, and color changes as well as visceral functions such as elimination. The behavioral system includes the maturational integration of the motoric and state system. Within this integration, the infant continually strives to balance approach and avoidance behaviors in response to stimuli, which is dependant on the maturation of the brain and nervous system.

The study of **growth** is illustrated (Wong, 1999: 118) that growth, maturation, differentiation, and development are interrelated, and are simultaneous, ongoing processes, none occurs apart from the others. The cephalocaudal trend of development is the most evident in total body growth as indicated by these changes, during fetal periods the head is the fastest growing part. The increasing of head circumference is related to brain growth. The majority of nerve cells form before birth, but dramatic changes occur after birth in the connections of these neurons into neural networks. The number of dendrites and the length of the dendrites and axons increase between birth and two years of age. As this result, the number of synapses between neurons increases enormously. Lowerey (1978) stated that the conduction velocity of nerves indicates maturational age, dependant on the thickness of the myelin sheath. The degree of myelination of peripheral nerve increases with age, but the changes are the most pronounced during the end of gestation and throughout the early years of life. Continuing, rapid brain growth and increasing in length characterize the last two months of gestation. The study of Smith (1977 cited in Manser, 1984) expressed that the interference with growth during the period of cellular hyperplasia will result in a permanent decrease in the cell number, in organ size, an in potential organ function. When the impedance to growth is removed, the velocity of growth may increase above that expected with a resumption to normal size. Gall and others (1986 cited in Berndt, 1997) have indicated that early experience in a normal environment can facilitate the fine-tuning of the connections between body (muscles and sense organs) and brain. Also the study of Sinclair (1985) has described that the peripheral nerve fibers exert a nutritive effect on the structures they supply, by means of a chemical secreated by the nerve cells and liberated of the nerve terminal. This substance modifies the growth and repair pattern of structures innervated.

Behavioral interaction is the mutually shared reciprocity of infant and mother. This is what is meant by attachment. The study suggested that early mother-infant contact have a positive effect on the developing relations of mother and infant (Chewwattana, W, 1994; Numprasert, W, 1996; Trisayaluck, T, 1998). Klaus and Kennell (1970) identified the progression of acquaintanceship between mother and infant as beginning at the periphery and moving inward. Mothers typically look at and touch extremities with fingertips, and then gradually progress to palm contact with the infant's trunk. Touching has been an important mediator in the development of mother-infant attachment and in infant's general well being. Infants pick up messages via the manner in which they are handled by the mothers' body language. Eye to eye contact with them combined with tactile stimulation and love and kindness will build a feeling of warmth and trust that is good for the learning development and social interaction of infants. Klaus and Kennell (1976: 77) stated that the visual system provided the most powerful networks for the mediation of maternal attachment. This adds to the sensitivity of the auditory perception of the infant. The infants are attracted to their mothers' speech that they had heard when they were in utero. Mother's voice is familiar to the infant. So the infant knows and is able to differentiate its mother's voice from that of other females. Thus, holding the infant in en face position and talking to him, enables the mother and infant to look directly into each other's eye, to focus and to regard each other, so maternal-infant attachment will be promoted as well.

With the techniques of the multi-modalities sensory stimulation program, a mother is able to feel more connected to her baby and there occurs a continuum. Maternal

and infant's behaviors complement each other through which the mother is rewarded by the resulting closeness with her infant and she can pleasurably experience the activity of her infant. It is a promising method as it has potential to integrate self-regulatory, sensory enrichment, within the setting of mother-infant contact--the interaction that begins with the acquaintance stage and develops towards attachment.

CHAPTER III

METHODOLOGY

This research study was a quasi-experimental research, aiming to determine the effects of collaborative role of nurses and mother implement the multi-modalities sensory stimulation program on growth of the premature infants and maternal infant attachment.

Population and sampling

Population. The population of this study was the mother-premature infant dyads. The infants were admitted to High-Risk unit, at the General Police hospital from July 2001 to February 2002.

Sampling criteria The researcher selected a sample by using a purposive sampling technique with the following inclusion criteria

Mother:

1. Vaginal delivery without complication after delivery;
2. Healthy;
3. Ability to speak, read, write, and understand the Thai language;
4. Willingly participated in this study.

Infant:

1. Gestational age between 32-36 weeks determined within the first 24 hours post delivery and was conducted by a doctor using the Ballard Score assessment;
2. Range in birth weight from 1,400 to 2,000 gm., and all weight being appropriate for gestational age;
3. APGAR score at 5 min. > 8;
4. Absence of congenital anomalies e.g. Congenital heart disease, CNS disturbance, Seizure disorders, and GI disorder;
5. Absence of O_2 therapy or intravenous replacement therapy;

Exclusion criteria:

Premature infants who were sick and received treatment such as O_2 therapy and/ or intravenous feeding during the period of study was excluded.

The study sample consisted of 40 mother-infant dyads. As instructed by Polit and Hungler (1983) an experimental research should be of at least 20-30 samples. For the sample of comparison, the number of sampling in each group should not be less than 10 samples depending on research design. In this study, the sample size was calculated from the group number X variable X constant (10) = 2 X 2 X 10 = 40. (Polit & Hungler, 1983: 426-427) The sample was divided into 2 groups equally, of which 20 were the control group, and the other 20 were the experimental group.

The sample was assigned to the control group first and then the experimental group later. This assignment method was selected to prevent contamination from

intervention due to the two groups meeting and exchanging knowledge and thoughts, and to prevent any discouraging influence on morale or the feeling of unfairness in intervention.

Setting

The study was conducted at a High-Risk Unit of the Police General Hospital where special care and nursing services were provided to infants weighing less than 2,300 grams at birth, including infants with non-crisis problems. The environment includes continuous fluorescent lights, and sometimes monitors and alarms. The conventional nursing staff are assessing the infants, performing routine care such as providing hygienic care, maintaining optimal hydration and nutrition, preventing complications, and helping the mother initiate breast-feeding. The infants were fed on a 3-hour feeding schedule. Initially a pacifier nipple was given to the infant for approximately 20 minutes and, then for optimal intake, the infants receive bottle-feeding by nurses. Open visiting hours were to encourage maternal visiting and breast-feeding for four times a day, at 8.30 a.m., 1 p.m., 5 p.m., and 8.30 p.m. For the first visit, the nurses will give the mothers instructions on infant care procedures and breast-feeding. There was a special room for breast-feeding located in the unit. They could touch, hold, and feed their infant based on readiness to achieve physiologic tasks both for mothers and infants. The healthy mothers will stay in the hospital at least 2 days after delivery. After being discharged, all of mothers can visit and take care of their premature babies from 8.30 a.m. to 9 p.m. Healthy premature infants were discharged at minimal weights of 2,000 grams and when adequate weight was gained.

Instrumentation

The instruments of this study were composed of the following:

1. The Research Instruments included.

1.1 Research protocol: Multi-modalities sensory stimulation program used in this study was modified from the sensory stimulation program of White-Traut and colleague (cited in Burns et al., 1994), and Field and colleague (1986) by Tinikul (2000) and was validated by experts. It will be provided to the experimental group.

This program covering 3 steps for 16 minutes a day, those steps are as follows:

Step I, Including of three activities within 10 minutes.

1.1 Playing taped music (Classical music) to premature for ten minutes

1.2 The first-5 minutes, providing tactile stimulation by gentle strokes through the areas of neck, upper back, both legs and both arms, and head for a second at each area, approximately 5 seconds per stroke. All activities includes the following steps: .

- from the area of the neck * 12 strokes
- from the neck to the waist * 12 strokes
- from the thigh to toe on both legs * 12 strokes.
- from the shoulder to the hand on both arms * 12 strokes
- from the forehead to both ears * 12 strokes

1.3 The second-5 minutes, providing vestibular and kinesthetic stimulation by slowly flexing and extending both legs and arms,

approximately 5 seconds per time. All activities includes the following steps:

-Flex and extend the right arm * 12 times

- Flex and extend the left arm * 12 times

- Flex and extend the right leg * 12 times

- Flex and extend the left leg * 12 times

- Flex and extend both legs * 12 times

Step II, re-providing tactile stimulation for 5 minutes.

Step III, providing visual stimulation by holding infant "en face" position, talking and making eye contact with infant for 1 minute.

Notes:

a. The multi-modalities sensory stimulation program was provided to infant 1 hour before or after feeding.

b. To avoid hypothermia, infants were in the controlled setting room while receiving sensory stimulation program.

c. During the intervention period, the signs of pale, slow respiration or apnea, weak muscle tone were closely monitored.

1.2 A stopwatch had been tested for validity with standard time.

1.3 Taped music with noise level at 60 or 65 dB, which was tested for level of sound by auditory research and study unit in Ramathibodi Hospital, was used to stimulate infants' auditory system. It was placed about 1 meter from

the infants' ears.

1.4 Growth measuring instruments included infant weight scale in grams and measuring tape in centimeter for measuring body length, and head circumferences.

2. Collected Data Instruments: (Appendix B) include

2.1 Personal Data Form consisting of 3 parts:

The first part consisted of socio-demographic--the basic personal data of the mothers, including age, address, educational level, family income, number of infant, and type of family.

The second part was socio-demographic--the basic personal data of the premature infants consisting of gestational age, sex, APGAR score, body weight, body length, and head circumference collected by the researcher from the medical record of infant, number of feeding per day, calories of formula intake.

The third part was growth data of the premature infants consisting of body weight, length, head circumference, health problems and feeding, completed by the researcher at 1 month after delivery.

2.2 A questionnaire to measure mother-to-infant attachment.

The Maternal Attachment Inventory (MAI) was developed and revised by Muller (1994). The researcher has adopted the MAI which was translated into Thai by Pornphan Jongpranee (1997). The questionnaire contents assessed maternal affectionate attachment to the infant. There are 26 items, likert type scale with 4 levels of evaluation with scores

1-4; "almost always" will be given 4 and "almost never" 1 score. The total scores are between 26-104 scores, High scores show high maternal affectionate attachment.

The quality of the instrumentation

Muller (1994) developed the Maternal Attachment Inventory (MAI). Items for the MAI were obtained from a thorough review of the attachment and maternal adaptation literature. Fifty-one items were identified and submitted to a group of 12 experts to quantify construct validity. Scores of each item given by the expert panel were calculated. The resulting, instrument contained thirty-one items, and then improve MAI internal consistency by eliminating of five items which correlation were consistency below .3. One hundred and ninety six women completed the MAI, approximately 1 month after the birth of their infant. Conbach's alpha coefficient for the MAI was .85.

The MAI was translated into Thai by Pornphan Jongpranee (1997) and validated by the group of 5 experts, then calculated for the reliability test with Cronbach's alpha with a result was 0.92 by using with the postpartal adolescent mother. Then, Tassanee Trisayaluk (1998) administered the MAI to 50 mothers of premature infant. Its Cronbach's alpha coefficient was .90.

In this study, the researcher has used this questionnaire to a sample of 10 mothers of premature infants. The reliability its Cronbach's alpha was .86. Next, it was used on the total sample of 40 cases, calculated at 0.87.

Protection of Human Subjects

The data collection procedure in this study encompassed the protection of the human subjects. Permission to conduct the study was requested to the commandant of Police General Hospital. The researcher began to collect data after permission was obtained to conduct the study. This study was performed based on the protection in this study. The researcher would explain the research objectives, the research process, benefits, duration of time for research cooperation and completion the questionnaire, and right to refuse to participate in the study to the adult human subjects. In the control group, the researcher explained research objectives, asked for research cooperation and completed a questionnaire, and also discussed the subjects' rights to refuse to participate. The subjects who agreed to participate were informed and assured that the data would be kept confidential and reported as group data. They could request information about the procedure in this study from the researcher at any time.

Collection of Data

An introduction letter issued by the Faculty of Graduate Studies, Mahidol University was sent to the commandant of the General Police Hospital, for cooperation in collecting of data. After getting the approval, the researcher met the supervisor nurse, head nurse of the Postpartum Unit, head nurse of the High-Risk Unit, and head nurse of pediatric O.P.D. to explain the research details and the collection of data as follows:

1. The researcher selected the sample group through the study of their medical records of premature infants at the High-Risk Unit.

2. The researcher met the mothers and introduced research objectives to them with a request for participation. When they agreed to participate in the study, the researcher ensured them human right to signed consent (Appendix A).

3. The researcher collected the first and second part of socio-demographic data of the sample from medical records and interviewing (Appendix B).

4. The first-twenty mother-infant dyads were assigned to the control group; the later were assigned to the experimental group. The researcher took the initiative to collect the data of the experimental group after the last infant of control group was discharged. During their hospitalization, the control group received conventional nursing care till they were discharged.

5. In the experimental group, mother-infant dyads received conventional nursing care in the same way, in conjunction with the multi-modalities sensory stimulation program. The sensory stimulation program consisted of 10 minutes auditory stimulation by playing music tape, and at the same time, initiating tactile stimulation for 5 minutes, and then 5 minutes later provide vestibular stimulation. Then, followed by re-providing 5 minutes of tactile stimulation. The final step was holding the infant in the en face position and talking with soft voice for a minute.

    5.1 The program was taught, demonstrated, and a manual was given to the mother for practicing.

    5.2 After maternal discharge, mothers will stimulate the infant at least four times a week. The researcher stimulated the infant on other days,

when the mother is unable to visit her infant.

5.3 The clinically stable premature infants will receive 16 minutes of sensory stimulation once a day until they discharged.

5.4 After the infant discharge from hospital, the mothers provided the multi-modalities stimulation program at home once a day until the infant was one month old.

6. Enhancing performance by calling them once a week.
7. The MAI (Appendix C) was administered to measure mother-to-infant attachment in both control and experimental groups, after her first visited to the baby and at the age of the infants at the age of one month.
8. In both control and experimental groups, the researcher measured the growth of the infants at first day of life and of the infants at the age of one month.
9. Then, absolutions of the data for statistical analysis.

Data analysis

By using statistical package for the social science: SPSS program

1. Comparing the personal data of both groups by using Chi-square test, and differentiation of both groups with Grouped t-test.
2. Range, average, and standard deviation of the growth of infants and maternal infant attachment scores were used, and analysis of covariance was performed.

CHAPTER IV

RESULTS

This study was a quasi-experimental research to determine the effects of the multi-modalities sensory stimulation program on maternal infant attachment and the growth of premature infants. Purposive sampling was used to select 40 pairs of mothers and their premature infants. The study was conducted at a high-risk unit of the Police General Hospital. The results of the data and statistical analysis are composed of the characteristics of the sample groups and the hypothesis testing results.

Characteristics of the sample group

The collection of data was carried out during July 2001 to February 2002 from the mothers and their premature infant. There were 112 cases of premature infants, but only 45 mother-infant dyads met inclusion criteria. Two infants were transferred to NICU and 3 cases did not come for a follow up. So a sample was 40 mother-infant dyads were the resulting group. The first twenty pairs were control group, and then the second twenty pairs were the experimental group. The demographic characteristics of the sample are presented in Table 1. When being analyzed by grouped t-test and Chi-square test did analysis, both groups were similar in their characteristics as shown in Table 2 and 3.

Table 1 Characteristics of samples in this study (N=40)

Characteristics	min-max	mean	SD
Maternal age (years)	16-40	25.27	5.99
Educational level (years)	4-16	9.28	3.30
Income (baths)	5,000-35,000	12,270	5,903.29
Gestational age (days)	32-36	34.15	1.31
Birth weight (gms.)	1,440-2,000	1,801.75	173.10
Body length (cm.)	41-48.5	44.36	1.71
Head circumference (cm.)	26.5-32	29.65	1.17
Apgar score at 5 min.	9-10	9.93	.27
Length of stay (days)	2-22	10.63	5.76
	(n)	(%)	
Family			
• Nuclear	28	70%	
• Extended	12	30%	
Antenatal care			
• Yes	35	87.5%	
• No	5	12.5%	
Parity			
• Primipara	26	65%	
• Multipara	14	35%	
Gender			
• Male	22	55%	
• female	18	45%	

Table 2 Comparison of characteristics of the sample group by grouped t-test

Characteristics	Control group			Experiment group			*p*
	min-max	Mean	SD	min-max	Mean	SD	
Mother							
Age (years)	16-40	25.55	6.47	16-34	25	5.63	.776 ns
Educational level (years)	4-12	8.25	2.45	6-16	10.3	3.7	.050 ns
Infant							
Gestational age (weeks)	32-36	34.4	1.27	32-36	33.9	1.33	.233 ns
Birthweight (grams)	1,440-2,000	1,732.5	179.29	1,570-2,000	1871	138.79	.010 *
Body length (cms.)	41-46	43.72	1.69	42.5-48.5	45	1.50	.016 *
Head circumference (cms.)	26.5-31.5	29.32	1.21	27-32	29.97	1.07	.081 ns
Apgar score at 5 min.	9-10	9.90	0.31	9-10	9.95	0.22	.560 ns
MAI pretest scores	76-103	91.45	7.07	61-103	93.30	9.24	.771 ns

*$p < .05$, ns $p > .05$

The results of this study showed that the characteristics of the mothers in two groups on age, and educational level and socio-demographic data of infant on gestational age, head circumference, Apgar score at 5 min., were not significantly statistically different ($p > .05$). But a statistically significant difference was found in birthweight and body length of infants.

Table 3 Comparison of characteristics of the sample group by Chi-square

Characteristics	Control group		Treatment group		X^2
	n	%	n	%	
Sex of infant					
Male	9	45 %	13	65 %	.204 [ns]
Female	11	55 %	7	35 %	
Number of pregnancy					
Primipara	12	60 %	14	70 %	.507 [ns]
Multipara	8	40 %	6	30 %	
Antenatal care					
Yes	19	95 %	16	80 %	.342[(a)]
No	1	5 %	4	20 %	
Type of Family					
Nuclear	15	75 %	13	65 %	.490 [ns]
Extended	5	25 %	7	35 %	
Family income					
5,000 – 10,000	12	60 %	5	25 %	
10,001 – 15,000	6	30 %	9	45 %	.064 [ns]
> 15,000	2	10 %	6	30 %	
Experimental group	**min-max:** 6,000-35,000		**X:** 14,515	**SD:** 6,217.91	
Control group	**min-max:** 5,000-20,000		**X:** 10,025	**SD:** 4,717.92	

[ns] p>. 05, [(a)] Fisher's test

The results of this study showed that the characteristics of two groups on sex of infant, parity, antenatal care, type of family, and family income groups were not statistically significant different (p> .05).

Growth of the infant and results of hypothesis

Hypothesis I The experimental group will have higher growth of the infants comprised of body weight, body length, and head circumference than the control group at one month after delivery.

The results of this study showed that increase of the growth of the infant at one month after delivery in comparison by using the analysis of covariance. The results revealed that the growth of infants in the experimental group have a significant treatment effect as shown in Table 4, 5, and 6. ($p < .05$). Thus the results supported hypothesis I

Table 4 Comparison of body weight between two groups at one month after delivery by analysis of covariance

Source	SS	df	MS	F
Covariates (pre weight)	232153.32	1	232153.32	3.471
Main effect	556280.627	1	556280.627	8.316 *
Residual	2474941.680	37	66890.316	
Total	3263375.63	39		

*$p < .05$

Table 5 Comparison of body length between two groups at one month after delivery by analysis of covariance

Source	SS	df	MS	F
Covariate (pre length)	24.428	1	24.428	13.302 *
Main effect	18.341	1	18.341	9.987 *
Residual	67.947	37	1.836	
Total	110.716	39		

*p< .05

Table 6 Comparison of head circumference between two groups at one month after delivery by analysis of covariance

Source	SS	df	MS	F
Covariate (pre HC)	5.667	1	5.667	6.164 *
Main effect	7.565	1	7.565	8.228 *
Residual	34.020	37	.919	
Total	47.252	39		

*p <.05

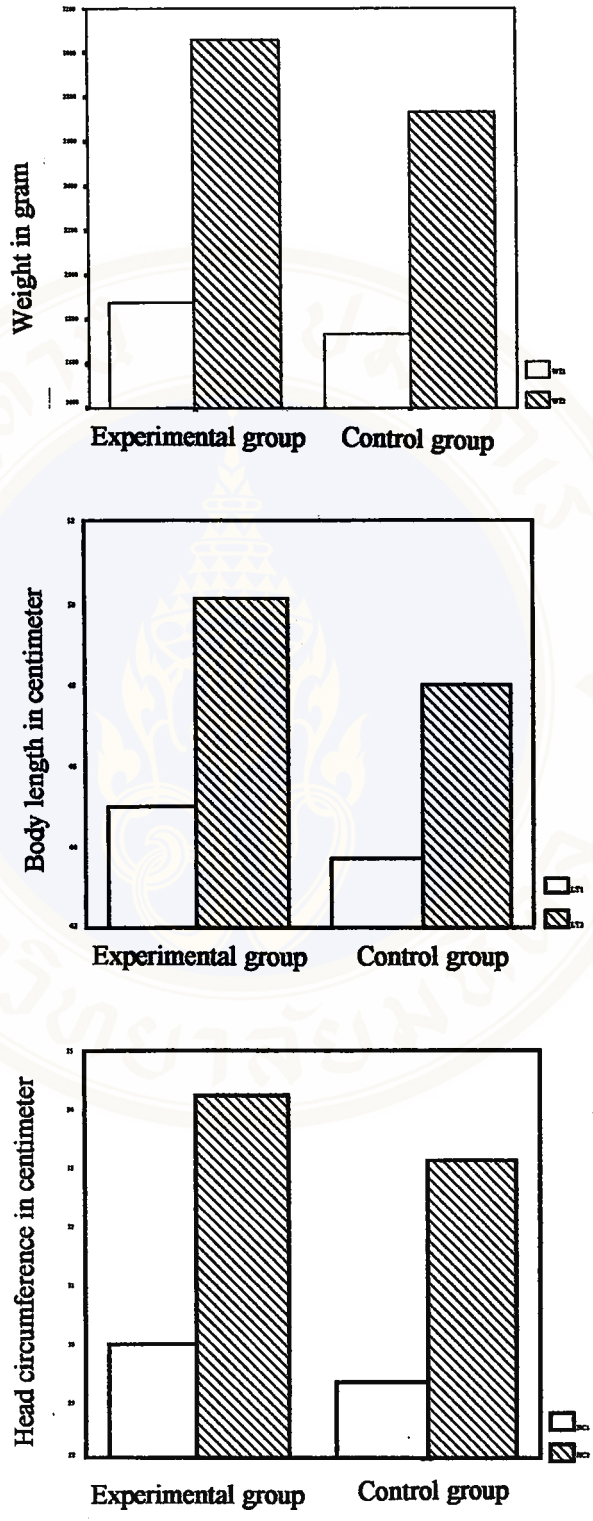


Figure 2. Means of growth of sample groups.

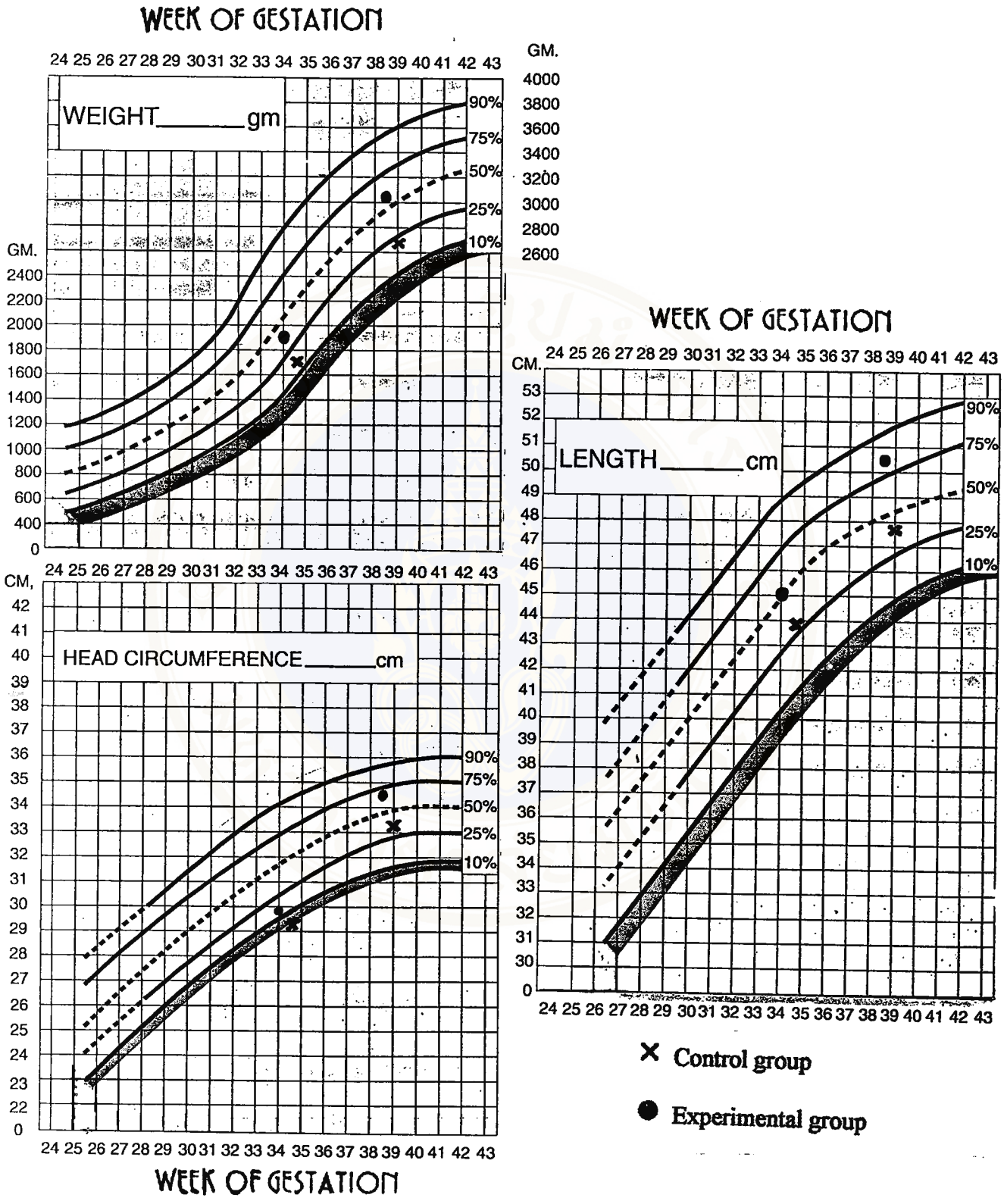


Figure 3. Mean of growth of sample groups.

(From Lubchenko,LC, Hansman C, Boyd,: J Pediatr 37:403, 1966; and Battaglia FC, Lubchenko,LC. : J Pediatr 71:159, 1967)

Maternal infant attachment scores and results of hypothesis testing

Hypothesis II The experimental group will have maternal-infant attachment scores higher than the control group of infant at one month after delivery

The results of the maternal-infant attachment scores measured after the first visit of premature infants' mothers: the experimental group showed an average of 93.30; the control group showed an average of 91.45. There was no statistically significant difference in mean maternal infant attachment scores between two groups ($p > .05$).

The measurement was conducted in comparison with maternal-infant attachment scores in the sample group at one month after delivery between both groups by testing influence on first measured scores against post-measured scores through regression analysis. It showed that the maternal infant attachment first measured scores have influence over post-measured scores with statistical significance ($\beta = .468$, $t = 5.721$, $p < .001$). So, when the maternal-infant attachment scores have been brought into comparison using the analysis of covariance, it found that the main effect has influence over the maternal infant attachment scores with statistical significance ($p < .05$) (Table 7). It showed that at one month after delivery the experimental group who received the multi-modalities sensory stimulation program and conventional nursing care had higher maternal-infant attachment scores than did the control group. So, the results supported hypothesis II.

Table 7 Comparison of the mother-infant attachment scores between both groups By analysis of covariance

Source	SS	df	MS	F
Covariate	515.346	1	515.346	32.695***
Main effect	78.577	1	78.577	4.985**
Residual	583.204	37	15.762	
Total	1177.127	39		

***p<. 001, **p< .01

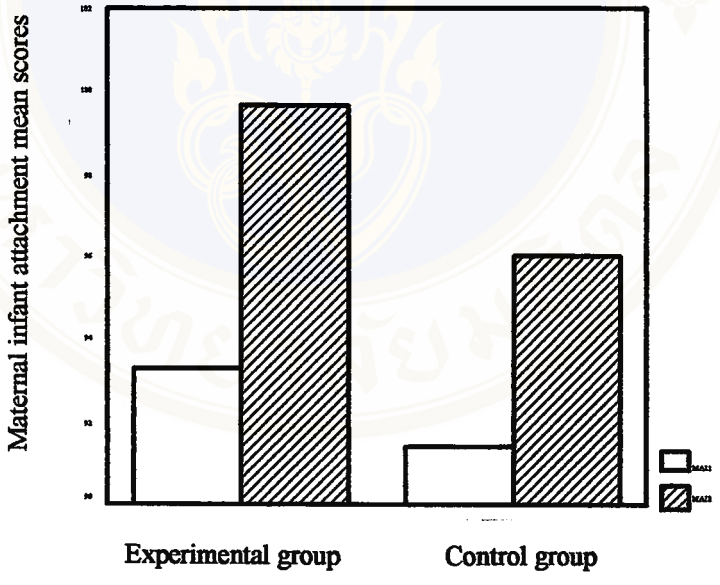


Figure 4. Maternal-infant attachment means scores of both groups

Hypothesis III The growth of infants and maternal infant attachment scores of the experimental group after implementing multi-modalities sensory stimulation program are higher than before implementation.

The results of study showed that at one month after delivery, after implementing program had higher growth and maternal infant attachment scores than implementation with statistically significant ($p < .001$). However, in the control group, there was the growth of infant increased higher than pre-measured with a statistical significance at the level of .001. The maternal infant attachment scores of the control group reach statistical significance at the level of .01 as show in Table 8.

Table 8 Comparison of growth premature infant and maternal infant attachment scores at the end of study by paired t-test.

Group	Pretest			Posttest			*t*
	Range	X	SD	Range	X	SD	
Experimental group.							
Weight (gms.)	430	1871	138.79	1220	3055.5	334.51	-16.163***
Length (cms.)	6	45	1.5	6	50	1.77	-13.508***
H.C. (cms.)	5	29.97	1.07	4	34.25	1.10	-13.749***
MAI scores	42	93.3	9.24	16	99.65	4.32	-4.380***
Control group.							
Weight (gms.)	560	1732.5	179.29	550	2730	174.87	-23.399***
Length (cms.)	5	43.72	1.69	5.5	47.97	1.31	-13.309***
H.C. (cms.)	5	29.32	1.21	4	33.12	0.93	-16.905***
MAI scores	27	91.45	7.07	22	96	6.26	-3.718**

***p <.001, **p<.01

A comparative growth and maternal infant attachment score pre-measured versus post-measure at one month after delivery conducted within each group. It has been found that there were increases of the average scores with statistically significantly in both the experimental and the control group.

CHAPTER V

DISCUSSION

This research was a study on the effects of the multi-modalities sensory stimulation program on maternal infant attachment and growth of the premature infants at the Police General Hospital. The number of cases was 40 pairs of mothers and infants devided into experimental and control groups with 20 pairs in each group. The characteristics of the sample groups and tested results of the hypotheses are discussed as follows.

Characteristics of sample groups

The mothers of premature infants are an average age of 25.2 years. Teenage mothers consisted of 27.5 % of the group. The majority with a percentage of 52.5 ranged from 20-30 years, which is the fertility age for having children. The percentage of primi-parity and multi-parity were 65 and 35 respectively. Majority of them with a percentage of 70% was nuclear family. Of both groups, 87.5 % of them followed up antenatal care regularly. The educational level was 4-16 years with an average of 9.28 years, 35 % had passed primary school, and 7.5 % were academic degree holders. 42.5 % of their family incomes were under 10,000 baht at and 37.5 % were in the range of 10,000-15,000 baht. Many studies conclude that low birth weight infants are closely associated with inadequate prenatal care, especially among adolescent mothers and those who live at a below the

poverty level (Wong, 1999; 393). In two cases of academic degree holders, which were government officers, their incomes were under 10,000 baht. However, the majority of the sample in this study had antenatal care regularly, and their past history included current pregnancy problems but did not indicated premature birth.

The socio-demographic data of premature infants within the experimental group includes body weight between 1,570-2,000 grams with an average of 1,871 grams, body length about 42.5-48.5 centimeters with an average of 45 centimeters, and head circumference between 27-32 centimeters with an average of 29.97 centimeters. The body weight in the control group was between 1,440-2,000 grams with an average of 1,732 grams, body length was between 41-46 centimeters with an average of 43.72 centimeters, and head circumference was between 26.5-31.5 centimeters with an average of 29.32 centimeters.

The researcher compared characteristic data of the sample groups by grouped t-test and Chi-square test, and found that they were not statistically significantly different as shown in Table 2 and 3. The characteristics such as birth weight and length were found different significantly; the researcher then analyzed the growth of infants by using analysis of covariance as shown in Table 4, 5, and 6.

Testing Results of Hypothesis

Hypothesis I The growth of body weight, body length , head circumference of the experimental group will higher than the control group at one month after delivery.

The research result showed that the premature infants in the experimental group had higher growth than in the control group at one month after delivery with statistical significance ($p < .05$) (Table 4, 5, and 6).

The hypothesis test is an assessment of the results of the multi-modalities sensory stimulation program by maternal involvement, which was designed especially for premature infants who were 32-36 weeks' gestation. A sample was similar in gestational age, sex of infant, Apgar score at 5 minutes, and head circumference ($p > .05$), but body weight and body length were significantly different ($p < .01$). The characteristic data, which would be important to test the influence on the growth such as body weight, body length, and head circumference pre-measured, were performed by analysis of covariance. The results showed that the main effect has influence over all body weight, body length, and head circumference post-measured with statistical significance at $p < .05$. This means that after covariant was eliminated, the experimental group, which received 16-minutes of program per day, still had higher growth than the control group.

Generally, the premature infants of more than 34 weeks' gestation who are appropriate for gestational age will tend to grow at the same rate as full-term infant of the same postconceptional age. These infants tend to be at approximately the 50^{th} percentile for length but slightly below the 50^{th} percentile for weight by 40-42 weeks' postconception (Blackburn, 1995). The composite of growth in the sample groups, which were average of 34.15 weeks' gestation, was plotted on standardized graphs, which identify normal values for gestational age and found that the sample groups showed

normal growth rates (between the 10th and 90th percentiles). When the growth rates are plotted according to the Ballard Scale, the growth of the experimental group was above the percentile range of growth chart as they were before. The graph showed at above the 50th percentile for body weight and head circumference and at above the 75th percentile for length whereas in the control group only head circumference was up to or above the old percentile range and still below the 50th percentile (Figure 3). That is a difference between both groups. So it can be assumed that supplemental stimulation such the multi-modalities sensory stimulation program influenced weight gained in the experimental group.

The researcher provided the program to the infants in the experimental group when they were clinically stable. After physiologic homeostasis is achieved the infant would be able to integrate into a social interactive experience. Many studies found that it was safe to stimulate. The stimulated infants were awake and active a greater percentage of the behavioral observation time and showed more mature habituation, orientation, motor activity, and range of state behavior on the Brazelton Scale (Field et al., 1986; Tinikul, S., 2000; White-Traut et al., 1997). The intervention approach was based on the synactive theory (Als, 1982) and focuses on fostering neurobehavioral and physiologic organization. The premature infant develops tone in a toe-to-head direction at average of 34 weeks' gestation. Premature infants rarely develop the degree of flexor tone, as do full-term infants. The intervention not only improves muscle development, but also encourages self-regulatory activities. Prone positioning enhances fetal tuck, a self-regulating behavior that serves to maintain motor system organization (Yecco, 1993). Tactile stimulation helped the infant to have a more mature range of state, and better habituation and motor maturities score (Field et al., 1986). Consequently, infant's sleep

patterns are organized, agitation prevented, and energy and calories preserved for their growth. The program applied to the infant offers sensory and physical stimulation during hospitalization and continued at home after discharge. Addition to the intervention with mother can help not only to enhance the infant's neurobehavioral organization and development but also to promote mother-infant interaction, which related to the maturation and functioning of the infant's sensory systems. Furthermore, the alert infant rewards the mother for her effects by following her with his or her eyes that Klaus and Kennell (1997) mentioned regarding maintaining their interaction and kindling the tired mother's fascination with her infant. The power of attachment is so extremely strong that it enables the mother to make the unusual sacrifice to care of her infant day after day and night after night. Therefore, it was timing that mother and infant would establish a pattern of synchronized and mutually rewarding interactions. So the growth could be explained in physiologic effects by sensory stimulation program with maternal involvement.

The findings of this study are consistent with the results of a previous study, White and Labarba (1976) studied group of premature infants that stimulated by nursing staff by four-15 minute period of tactile and kinesthetic stimulation daily for ten days. Experimental infants gained weight at a significantly greater rate over the 10-day treatment period compared to a control group. Field and associates (1986) findings demonstrated that the premature infants who received tactile/ kinesthetic stimulation consisted of body stroking and passive movements of the limbs for three, 15 minute period per day for ten days had averaged a 47 % greater weight gain per day than control infants. Findings of Kuhn and associates (1991) suggested that premature infants receiving tactile/ kinesthetic stimulation grew more during the study than did the non-stimulated infants and showed fewer behavioral sign of stress, also found the concentration of nor-epinephrine

and epinephrine rose significantly, which reflected maturation of sympathetic function. In Thailand, Eam-sila and others (1994) studied the effects of tactile stimulation and found that the premature infants, who were stimulated for fifteen minutes once a day, 2 weeks continuously, had a significantly higher weight and head circumference than un-stimulated infants.

Consequently the multi-modalities sensory stimulation program with maternal involvement improved growth of premature infant in the experimental group.

Hypothesis II

The experimental group had higher maternal infant attachment scores than control group at one month after delivery. The results showed that the experimental group had higher maternal infant attachment scores than in the control group at one month after delivery with statistical significance ($p < .05$) (Table 7).

Klaus and Kennell (1976) stated that the maternal attachment indicated since pregnancy was planned by the mother during pregnancy, throughout the period of birth and after birth. The majority of mothers in both groups (87.5%) have followed up antenatal care regularly that enable the fact of pregnancy to be accepted. The mother realized the existence of another person within her, fantasized about how the baby was and wished for a perfect healthy infant. So the results of this study showed high scores of maternal-infant attachment in both groups after they first visited their infant with no statistically significant difference ($p > .05$).

The researcher utilized early interaction techniques that helped the mothers to be successful in their emotional needs. They come to understand the special need for a

healthy growth pattern of a premature infant. Simultaneously, they were taught to read infant's cues, attend to signals from the infant which indicated opportunities for sensory stimuli and interaction. Initiating with touch or stroke, and talking softly to the infant which would be reassuring them. Then the researcher taught and modeled for them the multi-modalities sensory stimulation program to provide to their infants, who had been in their safe and clinically stable environment every day until one-month-old. The effects of multi-modalities sensory stimulation program in the study of Tinikul (2000) stated that after a ten day period of intervention the premature infants showed superior performance on the Brazelton neonatal behavior assessment. That pattern of program would be able to promote an affectionate tie between mother and her infant as well. Close contact with her infant helped mother to decrease her anxiety and understand the individual infant's behavior, could facilitate mother-infant relationship, and made the mother more confident. A possible explanation is that the experimental group has received positive effects of the multi-modalities sensory stimulation program.

In the clinical observations of Klaus and Kennell (1976) suggested that hospital practice, hospital personal, and the nature of the infant could have an influence on maternal attachment. The finding of Jongpranee (1997) asserted that social support was a statistically positive correlation to maternal-infant attachment. The sample group was adolescent mothers. Furthermore, the results of this study are consistent with the others' findings, which intervention was provided in an early postpartal period. Lojanawongsagorn (1998) found that giving information and details related to health conditions of the infant, the data helped the mothers in adjusting and reduced their anxiety and had higher scores of maternal-infant attachment than the control group were identified as having. The finding of Numprasert (1996) who studied the effect of kangaroo care

towards maternal infant bonding demonstrated that the experimental group had significantly higher scores than did the control group. According to Trisayaluk (1999) who studied the effects of maternal infant intervention, which was similar to this study but the samples were the hospitalized infants, with an assessment after two weeks, the results were that the experimental group had higher scores of maternal-infant attachment than did the control group. In accordance, Mercer and Ferketich (1994) postulated that maternal attachment was significantly correlated with maternal competence (perceived confidence in mothering role).

After maternal discharge, the visiting of their hospitalized infants in both groups was no different, 4-5 days a week. Unlimited visiting time during the day of the setting facilitates mothers to take care of and give breast-feeding to their premature infants. Interestingly, most of mothers in this study were caregiving, showing responsibility for their infant by themselves, which permitted both mother and her infant more time to get to know each other, to experience close contact, and to gradually develop a strong bond. Therefore, the maternal-infant attachment score in both sample groups statistically and significantly increased at the end of study (Table 8). The increasing of maternal-infant attachment scores told that the behavioral capacity of the infant results in a linking of the reactions between mother and her infant. Feeding, embracing, rocking, maintaining prolonged visual contact, and actively seeking opportunities for interaction with the infant all foster the development of an affective tie. The mother, however, will have an easier time adapting to the premature infant who is more responsive when provided with a good role model. The mothers in the experimental group gained much by learning to respond based on infant cues that help them and could better synchronize themselves with their infants. Caregiving based on infant cues involves attention to messages that indicate

timing for interventions, such as when to provide care, or opportunities for sensory input and interaction. In that way the infant responds positively to mother. As an infant is discharged, that appropriate care can assist the mother in making the transition from hospital to home, and continue the intervention in the home setting. Thus the experimental group had the benefit of maternal-infant interaction that would be able to be a positive influence on the mother-infant attachment. This may be the reason that mothers in the experimental group had significant higher maternal infant attachment scores than did the mothers in the control group.

The results of this study also supported the Klaus & Kennell's attachment theory that the context of early and extended contact for mother and infant could develop a strong tie between them in the first month of life.

Hypothesis III

After implementing multi-modalities sensory stimulation program, the growth of infant and maternal infant attachment scores of the experimental group were higher than before implementing program ($p < .001$). However, results showed that at one month after delivery both groups were increasing statistically significant in growth variable ($p < .001$). The maternal infant attachment scores of the control group reach statistical significance at the level of .01 (Table 8).

In the first week of life, all infants lose weight as a result of loss of free water and low intake. Most premature infants are also caloric and fluid restricted during that period as a result of illness. The premature infants in this study were 32-36 gestational age, an average of 34.15 weeks' gestation with under normal circumstances. They were also in transitional period which fluid and electrolyte homeostasis and maintenance caloric intake

becomes easier to achieve (Manser, 1984). The infants would receive adequate energy intake to have increased in weight. So that at one month after delivery they were characterized by increases in body weight, body length, and head circumference with a statistically significant ($p < .001$). Most of them attained growth parameters between 10 percent and 90 percent on standard growth chart which reflects normal rate of growth. However, at the end of study there was a slightly difference in increasing of means of growths between the experimental group and the controls that may be impacted by the effectiveness of intervention.

As well as the maternal infant attachment, most of mothers in this study are having a chance to take care their infants in the first month's period. They provide daily care such as bathing, feeding, and diapering to their infants at home. Klaus and Kennell (1976) postulated that prolonged contact between mother and infant after birth was crucial to the formation of an attachment bond. However, there are differences in the level of statistical significance between both groups. Mothers in the experimental group develop sensitivity in recognizing by which the infant communicates and use various sensorimotor means to interact with the infant that may be resulting in satisfying experience and emotional bond between them.

Finally, it can be concluded that the effectiveness of multi-modalities sensory stimulation program enhance the growth of premature infant and help mother to develop a successful behaviors in relationship with her infant as well.

CHAPTER VI

CONCLUSION

This research is a quasi-experimental research design aimed to determining the effects of the multi-modalities sensory stimulation program on maternal infant attachment and the growth of premature infants. The sample groups are the mothers of premature infants at the postpartum unit and their infants in high-risk unit, at Police General Hospital. The period of study was from July 2001 to February 2002.

Purposive sampling under criteria for eligibility. A sample composed of 40 pairs-selected mother-infant dyads, which divided into the experimental and control groups, at 20 pairs for each group. The experimental group consisted of the mothers of premature infant and their infants, who received the multi-modalities sensory stimulation program by maternal involvement and conventional nursing care. The control group received only conventional nursing care.

Research instrumentation included: 1) the multi-modalities sensory stimulation program and handbook, 2) taped music, 3) growth measuring instrument consisting of weight scale and measuring tape. The collected data instrument included: 1) a personal data form, 2) a questionnaire to measure mother-infant attachment, adopted from Jongpranee (1997).

Research steps were composed of the selection of sample under criteria, and the collected data through the sample groups. The researcher sought cooperation in research and in human rights. The mothers in both groups were assessed with a maternal-infant attachment questionnaire after their first time visit with their infant, and their infants were assessed for growth by the researcher. The control group received conventional nursing care. The experimental group received the multi-modalities sensory stimulation program as well as conventional nursing care. The mothers in the experimental group then practiced and provided to their infant once a day for one month after delivery. Both groups were assessed with the maternal-infant attachment questionnaire and growth of the infants by the researcher at the day follow up, one month old.

Results

1. The growth of infants in both groups was increasing with statistically significant ($p < .001$). However, at the end of study the mean weight of the experimental infants was 1184.5 g. as compare to 997.5 g. for the control infants. The mean increase in body length was 5 cm. for the experimental infants and 4.25 cm. for the controls. The increasing mean of head circumference of the experimental infants was 4.28 cm. and 3.8 cm. for the controls. Moreover, the experimental group showed significantly higher growth after the use of ANCOVA decreased the probability that any treatment effects will be mitigated by the covariate. Thus it can be explained that the multi-modalities sensory stimulation program results in increased growth of infants.

2. The experimental group had significantly higher maternal-infant attachment scores. Therefore it can be summarized that the multi-modalities sensory stimulation

program is beneficial to enhanced reciprocal interactions. After guidance, modeled intervention and encouragement, the mothers are reassured that they can respond appropriately to infant cues and have pleasure in caring for and interacting with their infant. It helps the mother in making the transition from hospital to home.

Research limitation

This research has limitations, notably the caloric intake factors. The researcher could not control amount of feeding in each day when they were home, which affects the growth of the infant. The infants were given different enteral feeding such as only breast-feeding, breast-feeding and supplementary bottle-feeding or only bottle-feeding.

Suggestion in application of research results

The results of this study have found that the multi-modalities sensory stimulation program was beneficial to the mothers of premature infants and their infant. This conclusion is from both theoretical and practical perspective, especially on premature infants by 32-36 weeks' gestation. An emphasis on self-regulation appears in the theoretical framework of Als (1982), and other studies which demonstrated that increased sensory stimulation has effect on infants. In particular, this stimulation produced better weight gain (Field et al., 1986; White & Labarba, 1976)). In addition to this, the infants spent more time in the active alert state, had a more mature range of state, and had better habituation and motor maturity (Field et al., 1986; Tinikul, 2000; White-traut et al., 1997). It is also revealed that the multi-modalities sensory stimulation program should enhance

the maternal-infant interaction by providing contact based on the infant's signals, including infant's state. Suggestion of this study was as follows:

1. Health professions especially pediatric nurses should recognize and promote maternal infant attachment for the growth of premature infants. Nursing staffs can serve as role models and facilitate the development mother-infant interaction; particularly, incubated premature infants who often spend long, perhaps critical weeks without full contact with their mothers. The program should be added as part of the care plan and adapted to each infant's condition for beneficial effects, and as a basis for appropriate discharge planning and maternal teaching.

2. The participation of the mother to this program should be included in the care of premature infants early during the infant's hospitalization. The mother should receive training before being discharged, and afforded intervention in the home setting with guidance from the nursing staff. They should progress in the care and interaction at their own pace. This way they establish positive relationships with their infants at an early age.

Recommendation for further study

1. The lack of distinction between intervention provided by mother or nursing staff in this study suggests that further study may focus on a maternally administered intervention as a means of improving the outcome, and developmental benefits that cannot be addressed by this study that need further investigation also.

2. Further study on this topic should be conducted to evaluate issues on both the growth and development of infants, and a longitudinal study in 3, 6 and 12 month.

3. To study in a healthy group who were discharged early from the hospital, and wherein the mother conducted intervention in the home, while measuring and following a longer period of time by home visiting.

4. To study in other groups such as infant high-risk for developmental delay, infant of maternal drug addicts.

BIBLIOGRAPHY

Adamson, S.(1993). Hands-on therapy. Health visitor. 66(2): 48-50.

Als, H.(1982). Toward a synactive theory of development: Promise for the assessment and support of infant individuality. Infant Mental Health Journal. 3: 229-243.

Als, H & Gilkerson, L. (1997). The role of relationship-based developmentally supportive newborn intensive care in strengthening outcome of preterm infants. Seminars in Perinatology. 21(3): 178-189.

Babson, SG Pernoll, MC Benda, GI (1980) Diagnosis and management of the fetus and neonate at risk: a guide for team care. Fourth edition. St.Louis: Mosby.

Behrman,R.E., Kliegman,R.M., Jenson,H.B. (2000). Nelson Textbook of Pediatrics. 16th edition. Philadelphia : W.B. Saunders.

Berndt, T.J. (1997). Child development. Second edition. USA: Brown & Benchmark.

Blackburn, S.(1995). Problems of preterm infants after discharge.JOGNN. 24(1): 43-49.

Blackburn, ST., VandenBerg, KA.(1993). Assessment and management of neonatal neurobehavioral development In C. Kenner, A. Brueggmeyer, LP. Gunderson,.(Eds.). Comprehensive neonatal nursing: A physiologic perspective.(pp.1094- 1133). Philadelphia: W.B. Saunders Co.

Bowlby, J. (1969). Attachment and Loss. Volume I. New York: Basic Books.

Brazelton, TB.(1999). Behavioral competence In GB. Avery, MA. Fletcher, MG. MacDonald, . Neonatology: Pathophysiology Management of the newborn. (pp. 321-332) Philadelphia: Lippincott Williams & Wilkins.

Burns, K et al. (1994). Infant stimulation: Modification of an intervention based on physiologic and behavioral cues. JOGNN. 23(7): 581-589.

Casaer, P. (1993). Old and new facts about perinatal brain development. Journal of Child Psychology and Psychiatry. 34(1): 101-109.

Chaze, BA & Ludington-Hoe, SM. (1984). Sensory stimulation in the NICU. AJN. 68-71

Chewwattana, W.(1994). The effects of the promotion on mothers' participation in feeding premature babies during hospitalization on mothers' satisfactio and the duration of breast feeding. Thesis of Master of Science (nursing), Faculty of graduate, Mahidol University.

Cook, JD. (1981). The therapeutic use of music: A literature review. Nursing Forum. 20(3): 252-266.

DeCasper,A.J.,Fifer,W.P.(1980). Of human bonding: Newborns prefer their mothers' voices. Science. 208: 1174-1176.

DePaul,D,Chambers,S.E.(1995). Environmental noise in the neonatal intensive care unit: Implications for nursing practice. Journal of Perinatatal Neonatal Nursing. 8(4): 71-76.

Dusick,A.M.(1997). Medical outcomes in preterm infants. Seminar in Perinatology. 21(3)(June): 164-177.

Ehrenkranz, RA. Et al., (1999). Longitudinal growth of hospitalized very low birthweight infants. Pediatrics. 104(2): 280-289.

Eam-sila, T. et al. (1994). The studied report The effect of tactile stimulation on the growth of premature infant. Faculty of Medicine, Siriraj Hospital Bangkok.

Erickson, M.E. (1996). Factors that influence the mother-infant dyad relationships and infant well-being. Issues in Mental Health Nursing. 17: 185-200.

Feldman,R.,Eidelman,A.I.(1998). Intervention programs for premature infants: How and do they affect development? Clinics in Perinatology. 25(3): 613-626.

Field, T.M.(1986). Interventions for premature infants. Journal of Pediatrics. 109(1): 183-191

_____(1995). Massage therapy for infants and children. Developmental and Behavioral Pediatrics. 16(2): 105-111.

Field,T.M.et al.(1986). Tactile/kinesthetic stimulation effects on preterm neonates. Pediatrics. 77(5): 654-658.

Fletcher, MA. (1998). Physical diagnosis in neonatology. Philadelphia: Lippincott.

Gairdner, D & Pearson, J (1971). A growth chart for premature and other infants. Achives of Disease in Childhood. 46: 783-787

Gardner,S.L. et al.(1993). The neonate and the environment: Impact on development. In Merenstein,G.B., Gardner,S.L. Handbook of Neonatal Intensive Care. St.Louis: Mosby Year Book.

Glass,P.(1999). The vulnerable neonate and the neonatal intensive care environment In G.B.Avery,. M.A. Fletcher, M.G. MacDonald ,Neonatology: Pathophysiology Management of the newborn. (pp.91-108). Philadelphia: Lippincott Williams & Wilkins.

Gorski,P.A. et al.(1990). Handing preterm infants in hospitals stimulating controversy about timing of stimulation. Clinics in Perinatology. 17(1): 103-112.

Goulet,C., Bell,L., Tribble,D., Paul,D., Lang,A.(1998). A conccept analysis of parent-infant attachment. Journal of Advanced Nursing. 28(5): 1071-1081.

Gray, K. et al.(1998). Developmentally supportive care in a neonatal intensive care unit: a research utilization project. Neonatal Network. 17(2): 33-38.

Haith, M.M. (1986). Sensory and perceptual process in early infancy. Journal of Pediatrics. 109(1): 158-169

Harrison,L.L., Woods,S.(1991). Early parental touch and preterm infants. JOGNN. 20(4): 299-306.

Harrison,L.L.et al.(2000). Physiologic and behavioral effects of gentle human touch on preterm infants. Research in Nursing & Health. 23: 435-446.

Higlet, A.M & Miller, M.A. (1996). The development of parenting: Nursing resources. JOGNN. 25(9): 707-713.

Huppi, P.S. et al. (1996). Structural and neurobehavioral delay in postnatal brain development of preterm infants. Pediatric Research. 39: 895-901

Jongpranee, P. (1997). Selected factors, social support and maternal newborn attachment in adolescent mothers. Thesis of Master of Nursing (Maternity and newborn nursing), Faculty of Graduate Studies, Mahidol University.

Katz, V. (1971). Auditory stimulation and developmental behavior of the premature infant. Nursing Research. 20(3): 196-201.

Kirby,H.D.(2000). Reverie pour enfant malade:The therapeutic power of music. Journal of neonatal nursing. 6(2): 56-58.

Klaus,M.H. et al.(1970). Human maternal behavior at the first contact with her young. Pediatrics. 46(2): 187-192.

Klaus,M.H. & Kennell,J.H.(1976). Maternal infant bonding. St.Louis: Mosby.

_____(1982). Parent- infant bonding. St.Louis: Mosby.

_____.(1997). Care of the mother, father, and infant. In A.A.. Fanaroff, R.J. Martin. Neonatal perinatal medicine: disease of the fetus and infant. 6th edition. vol.I (pp.548-561). St.Louis: Mosby.

Kramer, L.I. & Pierpont, M.E.. (1976). Rocking waterbeds and auditory stimuli to enhance growth of preterm infants. Pediatrics. 88(2): 297-299.

Korner,A.F.(1990). Infant stimulation: Issue of theory and research. Clinics in Perinatology. 17: 173-184.

Kuhn, C.M. et al. (1991). Tactile-kinesthetic stimulation effects on sympathetic and adrenocortical function in preterm infants. Journal of Pediatrics. 119(3): 434-440.

Legault, M. (1995). Comparison of kangaroo and traditional methods of removing preterm infants from incubators. JOGNN. 24(6): 501-506.

Letko, M.D. (1996). Understanding the APGAR score. JOGNN. 25(4): 299-303.

Lowrey, G.H. (1978). Growth and development of children . seventh edition. USA: Year Book Medical Publishers, Inc.

Lojanawongsagorn, P., (1998). Comparison of the effects of information provided to mothers of premature infants on levels of maternal stress and mother-infant

attachment. Thesis of Master of Nursing (Maternal-Child Nursing), Faculty of Graduate Studies, Mahidol University.

Ludington-Hoe, S.M. et al.(1999). Birth related fatigue in 34-36 weeks preterm neonate: Rapid recovery with very early kangaroo (skin-to-skin) care. JOGNN. 28(1): 94-103.

Manser, J.I. (1984). Growth in the high-risk infant. Clinics in Perinatology. 11(1): 19-39.

Marks, K.M. (1986). Growth of sick premature infant In S.A. Cohen, The underweight infant, child, and adolescent. USA: Appleton-Century Crofts.

Mercer, R.T. & Ferketich,S.L.(1990). Predicctors of parental attacchment during early parenthood. Journal of Advance Nursing. 15: 268-280.

_____.(1994). Maternal-infant attachment of experienced and inexperienced mothers during infancy. Nursing Research. 43(6): 344-351.

Ministry of Public Health. (1997). Public health statistics. Bangkok: War Veteran Welfare Organization.

Muller, M.E. (1994). A questionnaire to measure mother-to-infant attachment. Journal of Nursing Measurement. 2(2): 129-141.

Needman, R.D. (1996). Growth and development. In R.E.. Behrman, R.M Kliegman, A.M.Arvin. Nelson Textbook of Pediatrics. Edition 15th. (pp.30-33) Philadelphia: W.S. Saunder.

Nelson, D.(1986). Effects of tactile stimulation on premature infant weight gain. JOGNN. May/June: 262-267.

Nelson, D. & Heitman, R. (1986). Factors influencing weight change in premature infants. Pediatric Nursing. 12 (6): 425-428.

Numprasert, W.(1996). Kangaroo care for low birthweight infants of the bonding and adaptation roles on mothers. Thesis of Master of Nursing (Maternity and newborn nursing), Facculty of Graduate Studies, Mahidol University.

Oehler, J.M.(1993). Developmental care of low birthweight infants. Nursing Clinics of North America. 28(2): 289-297.

Olson, S.L..(1998). Bedside musical care: Applications in pregnancy, child birth, and neonatal care. JOGNN. 27(5): 569-575.

Pillitteri, A.(1999). Child health nursing: care of the child and family. Philadelphia: Lippincott.

Polit, D. & Hungler, B. (1983). Nursing research: principal and methods. Philadelphia: J.B. Lippincott Company.

Rausch, P.B. (1981). Effects of tactile and kinesthetic stimulation infants. JOGNN. , Jan-Feb: 34-37.

Schanberg, S.M. & Field, T.M. (1987). Sensory deprivation stress and supplemental stimulation in the rat pup and preterm human neonate. Child Development. 58: 1431-1447.

Sinclair, D. (1985). Human growth after birth. Fourth edition. New York: Oxford.

Siripoonya, P. & Boonprakop, U. (1993). Neonatology. Siriraj Textbook Project. Faculty of Medicine, Siriraj. Bangkok: Ruenkeaw Publishing.

Standley, J.M. & Moore,R.S.(1995). Therapeutic effets of music and mother's voice on premature infants. Pediatric Nursing. 2(6): 509-512.

Tinikul, S. (2000). A comparative study in the growth and development of premature infants between the groups of control and treatment under the multi-modalities sensory stimulation program. Thesis of Master of Nursing Science (Pediatrics Nursing), Faculty of Graduate Studies, Mahidol University.

Trisayalux, T. (1998). Effects of maternal infant interaction on maternal infant attachment and growth in premature infant. Thesis of Master of Nursing Science (Pediatrics Nursing), Faculty of Graduate Studies, Mahidol University.

Wakim, K.G. (1980). Physiologic effects of massage In J.B. Rogoff. Manipulation traction and massage. 2nd edition. (pp.45-50).USA: Williams & Wilking; 45-50.

Waterston, T, Platt, M.W., Helms, P. (1997). Pediatrics: understanding child health. Oxford: Oxford University Press.

Weiss, S. (1979). The language of touch. Nursing Research 28: 76-80.

White, J.L. & Labarba, R.C. (1976). The effects of tactile and kinesthetic stimulation on neonatal development in the preterm infant. Developmental Psychobiology. 9(6): 569-577.

White-Traut, R.C. et al. (1993). Patterns of physiologig and behavioral response of intermediate care preterm infant to intervention. Pediatricc Nursing. 19(6): 625-629.

_____. (1994). Environmental influences on the developing premature infant: Theoretical issues and applications to practice. JOGNN. 23(5): 393-401.

White-Traut, R.C. et al. (1997). Responses of preterm infants to unimodal and multimodal sensory intervention. Pediatric Nursing. 23(2): 169-175,193.

White-Traut, R.C.& Goldman, M.C.(1988). Premature infant massage: Is it safe? Pediatric Nursing. 14(4): 285-289.

Wong, D.L. (1999). Whaley & Wong's nursing care of infant and children. Sixth edition. St.Louis: Mosby.

Yecco, G.J. (1993). Neurobehavioral development and developmental support of premature infants. Journal of perinatal and Neonatal Nursimg. 7(1): 56-65.

Zahr, U.K., & Balian, S. (1995). Responses of premature infants to routine nursing interventions and noise in the NICU. Nursing Research. 44(3): 179-185.

APPENDIX

APPENDIX A

Human Rights for Research Population

For the control group subject

I am "Pol. Capt.Poonsin Charoensri" a graduate nursing student, Nursing Department, Faculty of Medicine, Ramathibodi Hospital, Mahidol University. I am interested in studying about the effects of multi-modalities sensory stimulation program. The study will be psychological benefit to the mother of premature infants and will help to improve quality of nursing care. I would like to ask you for cooperation by answering personal data within 24-48 hours after delivery. I will ask about the maternal infant attachment two times, first, before your discharge, and second, at 4 weeks after delivery and asked for the growth of your baby, too. It will take you around 20 minutes. If you have any questions, I would be glad to explain to you. All this information will be kept confidential and used only to present an overall table. Your name will not be appeared in the report or in any other place. If you would not like to participate in this study, you may withdraw from the study at any time. It will not affect you and your infant in any way.

Pol.Capt.Poonsin Charoensri
Graduate nursing student.

Signature.....
(.....)

For the treatment group subject

I am "Pol. Capt.Poonsin Charoensri" a graduate nursing student, Nursing Department, Faculty of Medicine, Ramathibodi Hospital, Mahidol University. I am interested in studying about the effects of multi-modalities sensory stimulation program. The study will be psychological benefit to the mother of premature infants and will help improve quality of nursing care. I would like to ask you for cooperation by answering personal data within 24-48 hours after delivery and, then will follow-up with you and your baby until you both are ready. I will demonstrate for sensory stimulation and follow-up your performance everyday until discharge and by telephoning or by posting once a week until 4 weeks after delivery. After your first contact the baby, you will be asked about the maternal infant attachment, and again, at 4 weeks after delivery and asked for the growth of infant, too. It will take you about 20 minutes. If you have any questions I would be glad to explain to you. All this information will be kept confidential and used only to present an overall table. Your name will not be appeared in the report or in any other place. If you would not like to participate in this study, you may withdraw from the study at any time.. It will not affect you and your infant in any way.

Pol.Capt.Poonsin Charoensri
Graduate nursing student.

Signature.....
(.....)

APPENDIX B

Personal Data Form

No..... Date.....

Part I: Personal data of mother

Direction: Put a mark (✔) infront the relevant answer in each item

1. Address.....telephone.....
2. Age.....years
3. Educational level..... Education time.....years
4. Family income per month.....baths
5. Type of family

   ( ) nuclear ( ) extended

6. Number of pregnancy

   ( ) primipara ( ) multipara

7. Antenatal care

   ( ) yes ( ) no

8. Infant care experience

   ( ) yes ( ) no

Part II: Personal data of premature infant

1. Date of Birth.....Time.....Sex.....Apgar score.....

2. Gestational age.....weeks, number of infant.....

   Body weight.....grams, Length.....cms.,

   Head circumference.....cms.

   Age of study.....days

3. Age at discharge.....days

   Body weight.....grams, Length.....cms.,

   Head circumference.....cms.

   Length of stay.....days

Part III: Growth record of the premature infant at 4 weeks

1. Body weight.....grams, Length.....cms.,

   Head circumference.....cms.

2. Caregiver.....

3. Health problem.....

4. Feeding

   ( ) Breast feeding ( ) milk.....oz./feed,.....feed/day

APPENDIX C

Maternal Attachment Inventory

Direction: The following sentences describe thoughts, feelings and situations you had occasional contact with yours baby after birth, and there are 26 items in the questionnaire. Answer the statements as you are feeling now. Read each sentence carefully and put a tick in the column, which most closely reflects your degree of always happen or not, all happen.

	Almost Always	Often	Some-times	Almost Never
1. I feel love for my baby				
2. I feel warm and happy with my baby				
3. I want to spend special time with my baby				
4.				
24.				
25. I comfort my baby when he/she is crying				
26. Loving my baby is easy				

(From Journal of nursing Measurement, vol. 2 (2), 1994)

APPENDIX D

List of expert consultant on validation of manual care for mother of premature infant:

1. Assoc.Prof. Naiphinich Kotchabhakdi Ph.D.

   Director of Neuro and Behavioral Biology Center, Institute of science and Technology for Research and Development, Mahidol University.

2. Assoc.Prof. Nittaya Kotchabhakdi M.D.

   Director of the National Institute for Child and Family Development for Thailand, Mahidol University.

3. Assoc.Prof. Wilai Lerthamtewe M.Sc.

   Faculty of Nursing, Mahidol University.

APPENDIX E

Table 9 Mean and standard deviation of maternal infanr attachment scores in each item of the sample groups.

	Control group				Experimental group			
	Pretest		posttest		Pretest		posttest	
	M	SD	M	SD	M	SD	M	SD
1. I feel love for my baby	3.85	.37	3.90	.31	3.90	.31	4.00	.00
2. I feel warm and happy with my baby	3.80	.41	3.90	.31	3.90	.31	3.95	.22
3. I want to spend special time with my baby	3.65	.59	3.55	.60	3.75	.44	3.75	.44
4. I look forward to being with my baby	3.70	.47	3.85	.37	3.70	.47	3.80	.41
5. Just seeing my baby makes me feel good	3.75	.44	3.80	.41	3.60	.82	3.95	.22
6. I know my baby needs me	3.55	.60	3.80	.41	3.70	.57	3.85	.37
7. I think my baby is cute	3.40	.60	3.55	.51	3.60	.60	3.95	.22
8. I'm glad this baby is mine	3.75	.55	3.85	.37	3.95	.22	4.00	.00
9. I feel special when my baby smiles	3.85	.37	3.95	.22	3.80	.70	3.95	.22
10. I like to look into my baby's eye	3.40	.75	3.65	.49	3.45	.76	3.82	.41
11. I enjoy holding my baby	3.25	.85	3.65	.49	3.30	.98	3.75	.44
12. I watch my baby sleep	3.35	.49	3.40	.50	3.50	.69	3.85	.37
13. I want my baby near me	3.80	.41	3.70	.47	3.85	.37	4.00	.00
14. I tell others about my baby	2.80	.89	3.30	.57	3.15	.67	3.35	.59
15. It's fun being with my baby	3.60	.75	3.65	.49	3.50	.61	3.75	.44
16. I enjoy having my baby cuddle with me	3.60	.82	3.80	.41	3.55	.76	3.80	.41
17. I'm proud of my baby	3.55	.60	3.75	.44	3.65	.59	3.90	.31
18. I like to see my baby do new things	3.30	.73	3.45	.60	3.65	.75	3.80	.41
19. My thoughts are full of my baby	3.40	.50	3.65	.49	3.55	.60	3.80	.52
20. I know my baby's personality	2.65	.93	3.35	.75	3.05	.76	3.60	.50
21. I want my baby to trust me	3.60	.75	3.60	.75	3.90	.31	3.90	.31
22. I know I am important to my baby	3.75	.44	3.85	.37	3.85	.37	3.95	.22
23. I understand my baby's signals	3.20	.83	3.70	.47	3.15	.67	3.70	.47
24. I give my baby special attention	3.65	.75	3.85	.37	3.65	.49	3.80	.41
25. I comfort my baby when he/she is crying	3.45	.69	3.65	.59	3.60	.75	3.85	.37
26. Loving my baby is easy	3.80	.52	3.85	.37	3.55	.69	3.90	.31

บัณฑิตวิทยาลัย มหาวิทยาลัยมหิดล
25/25 ถ.พุทธมณฑลสาย 4 ต.ศาลายา
อ.พุทธมณฑล จ.นครปฐม 73170
โทร 441-0177 โทรสาร 441-0177

ที่ ทม 0802.01 (ศย)/ 2245

12 มิถุนายน 2544

เรื่อง ขอความอนุเคราะห์ให้นักศึกษาเก็บข้อมูล เพื่อประกอบการทำวิทยานิพนธ์

เรียน ผู้บังคับการโรงพยาบาลตำรวจ

ด้วย ร.ต.อ.หญิงพูลสิน เจริญศรี นักศึกษาบัณฑิตวิทยาลัย มหาวิทยาลัยมหิดล หลักสูตรปริญญาโท สาขาวิชาการพยาบาลเด็ก คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี กำลังเสนอโครงร่างวิทยานิพนธ์เรื่อง "ผลของการกระตุ้นประสาทสัมผัสหลายรูปแบบ โดยมารดาต่อสัมพันธภาพระหว่างมารดากับทารก และการเจริญเติบโตของทารกเกิดก่อนกำหนด" อยู่ในความควบคุมของ ผศ.ดร.จริยา วิทยะศุภร ในการศึกษาวิจัย ครั้งนี้ นักศึกษามีความประสงค์จะเก็บข้อมูลจากมารดาหลังคลอดของทารกเกิดก่อนกำหนด อายุครรภ์ 33-37 สัปดาห์ ซึ่งพักฟื้นหลังคลอดที่หอผู้ป่วยสูติกรรม 6 และเมื่อพาบุตรมาตรวจรับวัคซีน เมื่ออายุ 1 เดือน ที่ห้องตรวจโรคกุมารเวชกรรม โดยใช้แบบสอบถาม เครื่องชั่งน้ำหนัก และสายวัดความยาวเป็นเครื่องมือในการวิจัย ตั้งแต่เดือนมิถุนายน 2544 ถึงเดือนกันยายน 2544

บัณฑิตวิทยาลัย จึงใคร่ขอความกรุณาจากท่านโปรดอนุเคราะห์ให้นักศึกษาได้เก็บข้อมูลเพื่อประกอบการทำวิทยานิพนธ์ ตามที่เห็นสมควรด้วย จักเป็นพระคุณยิ่ง

ขอแสดงความนับถือ

(ผู้ช่วยศาสตราจารย์ประกายรัตน์ สุขุมาลชาติ)
รองคณบดีฝ่ายบัณฑิตศึกษาศาลายา
ปฏิบัติราชการแทน คณบดีบัณฑิตวิทยาลัย

น.ต.อ. (อรรณพ เกรียงศักดิ์พิชิต)
นายแพทย์ (สบ 5) ฯ ปรท.ผบก.รพ.พต.
๒๙ มิ.ย. 2544

ติดต่อประธานคณะกรรมการควบคุมวิทยานิพนธ์ ผศ.ดร.จริยา วิทยะศุภร
โทร. 201-1673

BIOGRAPHY

NAME	Pol.capt.Poonsin Charoensri
DATE OF BIRTH	4 October 1961
PLACE OF BIRTH	Yasothon, Thailand
INSTITUTIONS ATTENDED	Police Nursing College, 1980-1984 : Diploma of Nursing Science (Equivalent to Bachelor Degree) Sukhothai Thammathirat University, 1992-1994: Bachelor of Public Health (Public Health Administration) Mahidol University, 1999-2002; Master of Nursing Science (Pediatric Nursing)
GRADUATE STUDY FUNDED	The Thesis Grant, Faculty of Graduate Studies, Mahidol University
POSITION & OFFICE	1984 -1996, Newborn unit. 1996 -present, Pediatric Intensive Care Unit Police General Hospital Position: Register nurse.

คู่มือ ส่งเสริมพัฒนาการทารกเกิดก่อนกำหนด ด้วยโปรแกรมการกระตุ้นประสาทสัมผัส หลายรูปแบบ

โดย ร.ต.อ.หญิงพูลสิน เจริญศรี
นักศึกษาพยาบาลศาสตรมหาบัณฑิต ภาควิชาพยาบาลศาสตร์
คณะแพทย์ศาสตร์ โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล

กิตติกรรมประกาศ

คู่มือส่งเสริมพัฒนาการทารกเกิดก่อนกำหนดนี้ ผู้เขียนประยุกต์จากแบบแผนการกระตุ้นประสาทสัมผัสทารกเกิดก่อนกำหนดของ ดร.ทิฟฟานี ฟิดส์ (1986) และ ดร.โรสแมรี ไวท์-เทราท์ (1997) ได้รับการตรวจสอบความถูกต้องของข้อมูลจาก รศ.ดร.นัยพินิจ คชภักดี ผู้เชี่ยวชาญด้านระบบประสาทและพฤติกรรม รศ.พญ.นิตยา คชภักดี กุมารแพทย์ผู้เชี่ยวชาญด้านพัฒนาการเด็ก รศ.วิไล เลิศธรรมเทวี อาจารย์พยาบาลผู้เชี่ยวชาญ การนวดสัมผัสในทารกเกิดก่อนกำหนด โดยมี ผศ.ดร.จริยา วิทยะศุภร เป็นอาจารย์ที่ปรึกษา อ.ดร.อัจฉรียา ปทุมวัน และ พ.ต.ท.พญ.นาเรศ วงศ์ไพฑูรย์ เป็นอาจารย์ที่ปรึกษาร่วม

ผู้เขียนขอขอบคุณทุกท่านที่ให้คำแนะนำ ใน การจัดทำคู่มือประกอบการศึกษาวิจัยในครั้งนี้ ขอขอบคุณ ร.ต.อ.หญิงกิตติวรรณ สมจิตต์ ที่ช่วยถ่ายภาพประกอบ และขอขอบคุณ คุณแม่ น้องปอนด์ ที่อนุญาตให้เป็นแบบในการถ่ายภาพประกอบ ทำให้คู่มือนี้มีความสมบูรณ์มากขึ้น

คำนำ

ในวัยทารกและเด็กเล็ก การเลี้ยงดูจากพ่อแม่และสิ่งแวดล้อม ประสบการณ์ที่เกิดขึ้นในช่วงปีแรก เป็นสิ่งสำคัญยิ่งในการพัฒนาให้ลูกฉลาดและมีคุณภาพ แม่-ลูกจะสามารถสร้างสายสัมพันธ์ต่อกัน ตั้งแต่แรกเกิด และเด็กจะสร้างความผูกพันได้ดีที่สุดในช่วง 2 ปีแรกของชีวิต ดังนั้นแม่จึงเป็นผู้ที่มีความสำคัญต่อลูกอย่างมาก ลูกจะรับรู้ถึงความห่วงใย จะรู้สึกปลอดภัย จากการดูแลเอาใจใส่ของแม่ หรือผู้ดูแลนั่นเอง

ด้วยความมุ่งหวังที่จะส่งเสริมให้ ทารกเกิดก่อนกำหนดมีพัฒนาการที่เหมาะสม และส่งเสริมความรัก-ความผูกพัน ระหว่างแม่-ลูก ผู้เขียนจึงได้จัดทำ คู่มือส่งเสริมพัฒนาการทารกเกิดก่อนกำหนด ด้วยโปรแกรมการกระตุ้นประสาทสัมผัสหลายรูปแบบเล่มนี้ขึ้นมา เพื่อช่วยให้คุณแม่มีความมั่นใจในการดูแลลูกน้อยยิ่งขึ้น และอย่างมีความสุข

ร.ต.อ.หญิงพูลสิน เจริญศรี

11 กรกฎาคม 2544

คุณแม่รู้มั้ยว่า.....

♥♥ สมองเป็นอวัยวะที่สำคัญที่สุด เพราะควบคุมการทำงานของทุกระบบในร่างกาย เริ่มมีพัฒนาการตั้งแต่สัปดาห์แรกตลอดและตลอด 40 สัปดาห์ของการตั้งครรภ์ และเจริญเติบโตอย่างรวดเร็วในช่วงแรกเกิดจนถึงอายุ 2 ปี มีการเพิ่มขนาดของเซลล์ มีการสร้างเส้นใยสมอง และจุดเชื่อมต่อขึ้นอย่างมากมาย รวมทั้งสร้างไขมันหุ้มล้อมรอบเส้นใยสมองด้วย เราจะสังเกตเห็นได้จากการเติบโตของศีรษะของทารกในระยะนี้

.....แต่ การเกิดก่อนกำหนดของลูกน้อย ซึ่งหมายถึงการคลอดก่อนอายุครรภ์ครบ 37 สัปดาห์ ทำให้การเจริญเติบโตไม่สมบูรณ์ตามวุฒิภาวะ.....

♥♥ ขณะที่ยังเป็นทารกอยู่ในครรภ์นั้น ลูกน้อยอยู่ในสิ่งแวดล้อมที่เหมาะสมต่อการเจริญเติบโต ได้รับอาหารจากแม่ผ่านทางสายสะดือ สามารถรับรู้จากประสาทสัมผัสได้ตั้งแต่ 6 สัปดาห์ก่อนคลอด เช่นการรับรู้ของประสาทตา รับรู้ความสว่าง ความมืด และลืมตาได้ รับรู้ประสาทการสัมผัสที่ผิวหนัง มีการเคลื่อนไหวไปมา ได้ยินเสียงการเต้นของหัวใจแม่อยู่ตลอดเวลา สามารถได้ยินและจำเสียงแม่ได้

♥♥ การเกิดก่อนกำหนด ทำให้ทารกต้องปรับตัวเข้ากับสิ่งแวดล้อมที่เปลี่ยนไป ต้องรับอาหารทางสายน้ำเกลือ มีการเคลื่อนไหวของแขน ขา นานๆ ครั้ง บนที่นอนภายในตู้อบ รวมทั้งกิจกรรมการดูแล รักษาต่างๆ ที่ทำให้ลูกน้อยต้องใช้เวลานาน ในการปรับตัว เพื่อให้การเจริญเติบโตเป็นไปตามปกติ

.....การกระตุ้นประสาทสัมผัสตามโปรแกรมนี้ จะช่วยคุณแม่ได้อย่างไร.....

♥♥ การกระตุ้นประสาทสัมผัสตามโปรแกรมนี้จะช่วยให้ลูกน้อยได้รับการกระตุ้นอย่างเหมาะสม เป็นประสบการณ์ที่ลูกได้รับจากความรักที่แม่มีต่อลูก การแสดงออกที่มีความหมาย การสัมผัสอย่างอ่อนโยน จะส่งผลทำให้ลูกเจริญเติบโต และมีพัฒนาการของสมองอย่างมาก

♥♥ สัมผัสที่นุ่มนวลของแม่ จะทำให้ลูกน้อยรู้สึกสบาย พึงพอใจ ขณะเดียวกันได้เรียนรู้ถึงความรัก ความเอื้ออาทรของแม่ เรียนรู้ว่าแม่คือ คนที่สามารถไว้วางใจได้มากที่สุด นอกจากนี้การนวดสัมผัสและส่งเสริมการเคลื่อนไหว ยังเป็นการเตรียมความพร้อมการใช้กล้ามเนื้อมัดใหญ่ของลูกน้อยในการพลิก คว่ำ คืบ คลาน ในช่วงเวลาต่อไปอีกด้วย

♥♥ จากการที่ลูกมองจ้องตา หรือเห็นสีหน้าอารมณ์ของแม่ ได้ยินเสียง พูดคุย หรือสัมผัสโอบกอด จะช่วยกระตุ้นสมองส่วนต่างๆ เกิดการเชื่อมโยงกัน ทำหน้าที่ต่างๆเช่นการสัมผัส การมองเห็น การได้ยิน และการเคลื่อนไหว ได้ดีขึ้น

♥♥ เสียงดนตรี เช่นดนตรีคลาสสิก นักวิทยาศาสตร์พบว่า นอกจากช่วยพัฒนาให้มีสุนทรียภาพทางอารมณ์ รู้สึกสงบ สบายขึ้นแล้ว ยังช่วยกระตุ้นการทำงานสมองอย่างเป็นระบบ พัฒนาสมาธิและความทรงจำ ทำให้ทารกมีโอกาสพัฒนาได้ดีในด้านมิติสัมพันธ์ และในเด็กโตยังพบว่า มีผลต่อการเรียนรู้ ด้านการแก้ปัญหาเชิงคณิตศาสตร์ได้ดี อีกด้วย

❤❤ ดังนั้นการกระตุ้นประสาทสัมผัสให้ลูกน้อยตามโปรแกรมนี้ โดยคุณแม่เป็นผู้ปฏิบัติ นอกจากจะเป็นปัจจัยพื้นฐานของความผูกพันทำให้เกิดความใกล้ชิดระหว่างแม่ลูกแล้ว ยังเป็นผลดีต่อการพัฒนาสมอง พัฒนาการด้านร่างกาย จิตใจ และอารมณ์ของลูกน้อยอีกด้วย

❤❤ ด้วยเหตุผลดังกล่าว จะเห็นว่าพ่อ-แม่ นอกจากจะเป็นผู้ถ่ายทอดสติปัญญาให้ลูกน้อยทางพันธุกรรมแล้ว ยังสามารถพัฒนาให้ลูกฉลาดจากประสบการณ์และการเลี้ยงดูตั้งแต่แรกเกิดได้อีกด้วย เช่นกัน

*.....**เรา** มาร่วมกันสร้างสมประสบการณ์ที่ดี เพื่อ ส่งเสริมพัฒนาการ การเจริญเติบโต และการเรียนรู้ให้กับลูกน้อยกันเถอะ.....*

คำแนะนำสำหรับคุณแม่ หรือผู้ปฏิบัติ มีดังนี้

1. ล้างมือให้สะอาดและถูมือให้อุ่นก่อน ทุกครั้งก่อนปฏิบัติ
2. ควรกระทำหลังอาบน้ำให้ลูกน้อย, หรือ
   ก่อน หรือ หลังมื้อนมประมาณ 1 ชั่วโมง, และ
   ลูกน้อยอยู่ในสภาวะตื่นตัว สงบ ไม่ง่วง หรือ ไม่งอแง
3. สถานที่ ควรเป็นบริเวณที่ถูกรบกวนน้อยที่สุด มีอากาศถ่ายเทดี ไม่ร้อนหรือเย็นเกินไป และ ลมไม่โกรกถูกตัวลูก
4. ขณะปฏิบัติ ถ้าลูกเหนื่อยเกินไป เริ่มเบื่อ หรือ ต่อต้าน ควรหยุดก่อน จึงค่อยเริ่มปฏิบัติใหม่เมื่อลูกพร้อม
5. สังเกตการเปลี่ยนแปลงขณะปฏิบัติ ถ้าผิดปกติเช่น สะอึก หรือ หาว ผิวกายเปลี่ยนสี ซีด คล้ำลง ให้หยุดทันที

ขั้นตอนปฏิบัติ 5 ขั้นตอน ใช้เวลาประมาณ 15 นาที มีดังนี้

1. กระตุ้นประสาทการได้ยิน และให้สัญญาณการเริ่มต้นด้วยการเปิดเพลง

   ☐ เปิดเพลงตลอดเวลาขณะกระตุ้นขั้นตอนที่ 2 และ ขั้นตอนที่ 3 ☐

2. กระตุ้นประสาทการสัมผัส ด้วยการลูบเบาๆ ใช้เวลา 4-5 นาที

จัดท่าให้ลูกน้อยนอนคว่ำ ลูบจากหัว ถึง คอ 10 ครั้ง

ลูบจากไหล่ ถึง ปลายมือ ทั้ง 2 ข้าง 10 ครั้ง

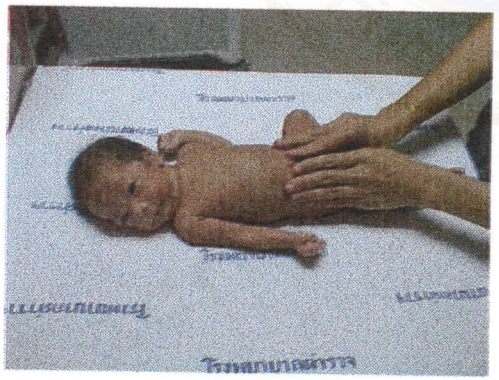
ลูบจากคอ ถึง เอว 10 ครั้ง

ลูบจากต้นขา ถึง ปลายเท้า ทั้ง 2 ข้าง 10 ครั้ง

3. กระตุ้นการเคลื่อนไหวและการทรงตัว ด้วยการงอและเหยียดใช้เวลา 4-5 นาที


จับให้ลูกน้อยนอนหงาย
ลูบจากหน้าผาก ถึง หู ทั้ง 2 ข้าง 10 ครั้ง


ลูกน้อยยังอยู่ในท่า นอนหงาย
จับแขนข้างขวา งอ และ เหยียด 12 ครั้ง

ลูบจากคอ ถึง ท้อง ให้ฝ่ามือสัมผัสบริเวณกว้างที่สุด 10 ครั้ง


จับแขนข้างซ้าย งอ และ เหยียด 12 ครั้ง

❀ *ขณะที่ปฏิบัติขั้นตอนนี้ คุณแม่หรือผู้ปฏิบัติอาจวางมือ อีกข้างบนบริเวณหน้าอกของลูกน้อย เพื่อปลอบให้สงบ และ ไม่ผวา ตกใจ*


จับขาข้างขวา งอ และ เหยียด 12 ครั้ง


จับขาทั้ง 2 ข้าง งอ และ เหยียดพร้อมกัน 12 ครั้ง

***** ปิดเพลง *****

4. กระตุ้นประสาทการสัมผัส เหมือนขั้นตอนที่ 2 อีกครั้ง ใช้เวลา 4- 5 นาที

❀ *หลังจากเสร็จสิ้นขั้นตอนนี้แล้ว คุณแม่แต่งตัวให้ลูกน้อยก่อน จึงเริ่มขั้นตอนต่อไป* ❀

5. กระตุ้นประสาทการมองเห็น และสร้างปฏิสัมพันธ์ ด้วยการอุ้มอย่างอ่อนโยน ประคองศีรษะหันหน้า เข้าหากัน ระยะห่าง 8 - 12 นิ้ว


จับขาข้างซ้าย งอ และ เหยียด 12 ครั้ง

สบตาและพูดคุยด้วยเสียงเบาๆ กับลูกน้อย ประมาณ 1- 2 นาที

เอกสารอ้างอิง

มี๊ด จอห์นสัน .(2543). ***Smart symphonies ดนตรีคลาสสิก ช่วยกระตุ้นการพัฒนา***
ของลูกน้อย. โครงการ มี๊ด จอห์นสัน สมาร์ท ซิมโฟนีส์. 26 มกราคม 2543.
ศูนย์วัฒนธรรมแห่งประเทศไทย.

Burns, K.,et al. (1994). Infant stimulation: Modification of an intervention based
phisiologic and behavioral cues. ***JOGNN***. 23(7): 581-589

Field, T.M., et al. (1986). Tactile/ kinesthetic stimulation effects on preterm neon
Pediatrics. 77(5): 654-658

White-Traut, R.C.,et al. (1997). Response of preterm infants to unimodal and
multimodal sensory intervention. ***Pediatric Nursing***. 23(2): 169-175

ตารางบันทึกการปฏิบัติ

ครั้งที่	ว.ด.ป.	เวลา	การตอบสนอง			ทำครบ	หมายเหตุ
			ดี	เฉยๆ	ปฏิเสธ		
1							

ครั้งที่	ว.ด.ป.	เวลา	การตอบสนอง			ทำครบ	หมายเหตุ
			ดี	เฉยๆ	ปฏิเสธ		

✿ กรุณาบันทึก อาการเปลี่ยนแปลงของลูกน้อย ที่เกิดขึ้นขณะปฏิบัติ เช่น หาว สะอึก สีผิวซีดลง ในช่องหมายเหตุ