Available online at www.sciencedirect.com
SCIENCE DIRECT®
International Journal of Nursing Studies 43 (2006) 139–146
INTERNATIONAL JOURNAL OF NURSING STUDIES
www.elsevier.com/locate/ijnurstu

Randomized controlled trial of music during kangaroo care on maternal state anxiety and preterm infants' responses

Hui-Ling Lai[a,b,*], Chia-Jung Chen[a], Tai-Chu Peng[c], Fwu-Mei Chang[d], Mei-Lin Hsieh[e], Hsiao-Yen Huang[f], Shu-Chuan Chang[a]

[a]*Department of Nursing, Tzu Chi Medical Center, Taiwan, ROC*
[b]*Department of Nursing, Tzu Chi College of Technology; Tzu Chi University, Taiwan, ROC*
[c]*Nursing Department, Tzu Chi College of Technology, Taiwan, ROC*
[d]*Tzu Chi University, Taiwan, ROC*
[e]*Department of Nursing, Tzu Chi University, Taiwan, ROC*
[f]*Nursing Department, Monnonite Christian Hospital, Taiwan, ROC*

Received 20 November 2004; received in revised form 11 April 2005; accepted 26 April 2005

Abstract

The purpose of this randomized controlled trial was to investigate the influences of music during kangaroo care (KC) on maternal anxiety and preterm infants' responses. There are no experimental studies that explore the influences of combination of music and KC on psychophysiological responses in mother–infant dyads. Purposive sampling was used to recruit 30 hospitalized preterm infants body weight 1500 gm and over, gestational age 37 weeks and lower from two NICUs. Mother–infant dyads were randomly assigned to the treatment and the control group using permuted block randomization stratified on gender. There were 15 mother–infant dyads in each group. Subjects in the treatment dyads listened to their choice of a lullaby music during KC for 60 min/section/day for three consecutive days. Control dyads received routine incubator care. Using a repeated measures design with a pretest and three posttests, the responses of treatment dyads including maternal anxiety and infants' physiologic responses (heart rate, respiratory rate, and O_2 saturation) as well as behavioural state were measured. The results revealed that there were no significant differences between the two groups on infants' physiologic responses and the values were all in the normal range. However, infants in the treatment group had more occurrence of quiet sleep states and less crying ($p < 0.05-0.01$). Music during KC also resulted in significantly lower maternal anxiety in the treatment group ($p < 0.01$). Maternal state anxiety improved daily, indicating a cumulative dose effect. The findings provide evidence for the use of music during KC as an empirically-based intervention for bahavioural state stability and maternal anxiety in mother–infant dyads.

Keywords: Kangaroo care; Music intervention; Preterm infant; Anxiety; Behavioural state

What this paper adds

What is already known about this topic?

- Kangaroo care (KC) for preterm infants has been reported to have beneficial effects for parents and infants.

*Corresponding author. Nursing Department, Tzu Chi General Hospital, 707, Section 3, Chung Yang Road, Hualien, 970 Taiwan. Tel.: 03 8561825x2263.
E-mail address: snowjade@mail.tcu.edu.tw (H.-L. Lai).

0020-7489/$ - see front matter © 2005 Elsevier Ltd. All rights reserved.
doi:10.1016/j.ijnurstu.2005.04.008

- Previous studies have found that soft music had beneficial effects on psychophysiological responses.

What do we now know as a result of this study?

- This is the first randomized controlled trial of music during KC on maternal anxiety and preterm infants' responses. It showed that a lullaby music intervention improved infants' quiet sleep and less crying.

1. Background

There are approximately 300 thousand newborn babies in Taiwan each year, of which 8–10% are prematurely born. That makes 30 thousand premature babies each year (Premature Baby Foundation of Taiwan, ROC., 2004). These babies and their parents are confronted with numerous frustrations, worries and other psychophysiological burdens. Reviewers found that parenting a prematurely born infant begins with a psychological perspective that is different from parenting a full-term baby. The life-threatening events associated with the NICU experience, compounded by the differences in the needs and behaviour of preterm infants, present a considerable challenge to mothers (Miles et al., 1998). Mothers of premature infants experience stress and other emotional responses related to the birth, hospitalization, and long-term care needs of their infants. Parenting premature infants may be affected by such emotional responses. Anxiety disorders may develop before or at any time during the perinatal period and can coexist with other stressors. Anxiety in relation to their pretem infant's behaviour is one of the common perceptions of parents (Neu, 1999).

Advances in technology have resulted in increasing survival rates even for extremely premature infants. While sophisticated medical management is vital to infant survival, research has found that alternative interventions are important factor of infants' later outcome. Consequently, evidence is accumulating to demonstrate the fundamental role of neonatal nurse and mothers to the optimal developmental outcome of premature infants. Numerous factors can increase a preterm infant's risk for disease and impairment and the neonatal nurses can perform a significant role in minimizing this risk and promoting positive outcomes.

KC for preterm infants has been reported to have beneficial effects for parents and infants. Music and KC are two of the frequently being used complementary care in the neonatal intensive care unit (Burke et al., 1995; Jones and Kassity, 2001). Many nurse researchers have adopted KC as a result of research in several populations of term and premature infants yielding positive physiologic results. Smith's study involving spontaneously breathing preterm infants during skin-to-skin care indicate no energy depletion in terms of thermoregulation, oxygenation, heart rate, and sleep states.

These parameters did not differ significantly at the 5% level in the KC group when compared to the incubator routine care (Smith, 2001). As a matter of fact, with proper medical and nursing care, babies born prematurely can lead a normal neonatal life and be as robust and active as full-term infants.

Yet little research using music during KC has been conducted on this group of mother–infant dyads in terms of their psychophysiological responses. Thus, the aim of the study was to test the effects of music during KC on maternal anxiety and preterm infants' responses.

2. Literature review

2.1. Kangaroo care

It is well known that KC was originally developed to overcome problems associated with traditional incubator care in developing countries. KC was proposed as a caring alternative for low birth weight (LBW) infants. These results show that KC is a safe approach to the care of clinically stable LBW infants. KC is a method of holding an infant in skin-to-skin contact, prone and upright on the chest of the parent. During KC, the infant is removed from the neutral thermal environment of the incubator or radiant warmer for contact with the parent's skin and clothing to ensure that his or her body maintains the infant's temperature.

The use of KC holding of neonates, is gaining acceptance as a standard of care in (NICUs) around the world. A systematic review by Davis et al. (2003) have found that KC promotes parental feelings of mastery, crisis resolution, positive attitude toward the infant, emotional completion of the pregnancy, and increased length of breastfeeding when compared with control groups. Infants experienced both heart rate and temperature increases during kangaroo care, these values remained within normal limits (Bauer et al., 1997). Other studies have supported that KC improved survival, earlier hospital discharge, prolonged lactation, and reduced behavioural problems have been associated with this care modality (Charpak et al., 1997; Sloan et al., 1994). However, in contrast to these studies on the effects of KC, a recent study by pediatricians revealed that KC was associated with a significant increase in the combined frequency of bradycardia and hypoxemia and with less regular breathing (Bohnhorst et al., 2001). Regarding the findings of those previous research, more studies concerning KC are needed.

2.2. Music intervention

Music is known to affect the individual by sympathetic resonance. Based on a psychophysiological theory synthesized from the literature, certain type of music induces relaxation and pleasure responses (Lai and Good, 2002), which reduce activity in the neuroendocrine and sympathetic nervous systems, resulting in decreased anxiety, heart rate, respiratory rate, and increase temperature (Lai, 2004). Researcher had postulated that addressing music selection is imperative when conducting music intervention. Music preference plays a large role because people generally like what they know and dislike the unfamiliar (Lai and Good, 2002).

Music therapy has become incredibly popular of the past decade, resulting in a spectrum of phonic stimuli from simulated heartbeats to an assortment of classical music used to ease and augment a baby's NICU stay. Numerous investigations have studied the effects of music on infants. Playing lullabies to premature infants in NICUs can have positive outcomes, which included gaining more weight, improved oxygen saturation, and shortened hospital stay than controls, but this was not statistically significant (Marwick, 2000). Standley and Moore (1995) reported findings on the therapeutic effects of music and mother's voice on premature infants during a period of 3 consecutive days. Infants hearing music had significantly fewer occurrences of oximeter alarms during auditory stimuli than did those listening to the mothers' voice alone.

The current study was undertaken to obtain further insight into the maternal and infants experiences of music during KC. Understanding the effects of music during KC may guide neonatal nurses to enhance the independence of nursing care and the interaction between parents and their infants who are fragile. The aim of the study was to test the hypotheses that, (1) while controlling for identified covariates, the maternal anxiety of mothers who received music during KC did not differ significantly from the control group over time and (2) there were no significant differences between groups on preterm infants' responses (physiological stability and bahavioural state).

3. Method

3.1. Design

A randomized controlled trial, repeated measure design was used. Because female infants have a significantly greater chance of surviving than male infants at similar birth weights and gestational ages, and have an advantage over males for a better outcome with less morbidity (Elsmen et al., 2004), permuted block randomization with sealed envelopes stratified on gender, was used to assign participants to either the treatment or control group ($n = 15$) to ensure equal distribution across the groups. The envelopes were prepared by a different person so that the investigators (first author) were blind to block size and order of assignment.

Mother–infant dyads in the treatment group were exposed to music during KC for 60 min/day for three consecutive days. Control group infants lying prone in the incubator received routine care during the study period.

3.2. Setting and subjects

Subjects were a convenience sample of 30 mother-preterm infants dyads admitted to NICUs in two general hospitals in eastern Taiwan. To achieve a power of .8 at $\alpha = .05$, one-tailed, with a medium effect size = 0.6 (Standley, 2002), a medium correlation ($r = .50$) among four repeated measures, and using F test (Cohen, 1988), the size of each group was computed to be 12 (Stevens, 1996). Measures were obtained once per day for three days, and so 20% was added for attrition. As a result, 15 participants were recruited for each group. Study infants met the following criteria: (1) weight at time of study over 1500 gm; (2) gestational age of 37 weeks or less; (3) no undergoing mechanical ventilation; (4) no phototherapy; (5) no congenital abnormalities; and (6) no symptomatic sepsis.

3.3. Measures

3.3.1. Maternal state anxiety

Maternal state anxiety was measured by using the State-Trait Anxiety Inventory (STAI) Scale Form Y-1 (Spielberger, 1983). The STAI Form Y-1 consists of 20 self-descriptive statements for the state anxiety scale. Subjects respond on a four-point Likert-type scale. The range of possible scores on each is from 20 to 80 points. Higher scores indicate greater anxiety. The construct validity of the state-anxiety scale was examined by testing military recruits after a stressful training program. The military recruits had significantly higher state-anxiety than high school students who were at about the same age and were tested in less stressful situations (Spielberger, 1983). For the state anxiety scale, the test–retest correlation coefficients were from .16 to .54 for college students and were .34 to .62 for high school students. The STAI has been translated into more than 30 languages including Chinese for cross-culture research (Spielberger and Diaz-Guerrero, 1983). The Chinese STAI also has a high Cronbach alpha of 0.9 (Shek, 1988) and correlated significantly with other measures of psychologic well being and established concurrent validity (Shek, 1993). In this study, the alpha

coefficient was .90 for the Chinese version of the state anxiety scale.

3.3.2. Infants' responses

Infants' responses in this study included physiologic parameters and behevioural state.

Physiologic parameters. Physiologic parameters were measured by infants' oxygen saturation, heart rates, and respiratory rates. Oxygen saturation was measured with the continuous display on the Nellcor 180 pulse oximeter (Nellcor Inc., Hayward, CA) that was attached by adhesive sensor either across the palm of the hand or on the anterior of the foot. According to specifications of the manufacturer, accuracy of the monitor when using the N25 sensor is ± 2. All infants were monitored for heart rate with the same medical device. Three leads were applied in a triangular pattern on the infant's chest. According to the manufacturer, the update time for the continuous numeric display is 2 s, and accuracy of the analog display is ± 3 beats/min. Infants' respiratory rates were measured by the investigators for one minute.

Infants' body temperature was not measured in this study because of two reasons. First, in previous studies of physiologic effects of KC in preterm infants, both peripheral skin temperature and core temperature were not lower than the respective temperatures in the incubator (Bauer et al., 1997). The second reason was to minimize potential interference of the study protocol by measuring temperature. In order to guard against infants' physiologic disorganized, all the physiologic parameters measured in this study were continuously taken at 10 min interval for 60 min, but only the baseline data and the last time of the measurement were taken into account for comparing group differences.

Behavioural state. Behavioural states of infants were recorded throughout the observation period on the behavioural state instrument (BSI) developed by the investigators. Five different behavioural states were distinguished: State 1 = quiet sleep, State 2 = active sleep, State 3 = drowsy, State 4 = quiet awake, State 5 = active awake and State 6 = crying.

The BSI's content validity was investigated by elucidating its general appropriateness, applicability, and feasibility of the measurement procedure. Data were collected from three clinical experts. Each expert independently judged and reviewed the instrument's content validity. The results show that the content validity index (CVI) values ranged from 0.8 to 1.0 for the instrument's general appropriateness, and from 0.87 to 0.95 with respect to the significance of the applicability. The feasibility of the measurement procedure was estimated in the time needed and material used, with CVI values ranging from 0.90 to 1.0.

After an initial 10 min of stabilization, infants' behavioural state was observed every 10 min during a continuous 30 s assessment. The highest state was recorded. All observations were carried out by three senior neonatal nurses who were well trained and remained at the bedside throughout the protocol for each infant. Inter-rater reliability of the observation using the BSI was 0.93 for the investigators. The results showed that the BSI had satisfactory validity and reliability.

3.4. Experimental intervention

The music intervention consisted of a choice of one of three types of lullaby music played for 60 min during KC. Because the optimal period of time of KC has been found to take about 30–60 min (Bell and McGrath, 1996), we decided to use 60 min of music during KC every day. The choices included western vocal, instrumental lullaby and aboriginal Taiwanese lullaby CD. Mothers in the music group were asked to select the type that was most preferable and relaxing to them. Then, the investigator replayed the selected music for two minutes at a comfortable volume. The music was played on a Philips AZ-1103.

3.5. Procedure

The study protocol was approved by the ethics committee of the nursing department and was conducted between September 2002 and May 2003. Informed consent was obtained from the legal guardian of each study infant. When eligibility criteria were met, the study was scheduled for the afternoon of the same day. The study protocol and the measurement always started at the same time of day, 1 h after the last feeding, and did not interfere with the 60 min nursing routine. All the maternal and infants' baseline data were taken before the intervention began. For each group observation began after an initial 10 min of stabilization. Observations of behavioural state were made every 10 min for the next 60 min. Any interventions and treatments were avoided during the study protocol. Three posttest measures of maternal anxiety were obtained on the STAI at the end of the intervention of day 1, day 2, and day 3. The protocol of music during KC was as follows:

1. Before initiating KC, the mother was asked to select a music she preferred.
2. The infant's primary nurse swaddled the diaper-clad infant with a blanket and positioned the infant prone.
3. Immediately before transfer, the primary nurse unswaddled and placed a cloth diaper over the infant.
4. Mothers placed a front-opening cover gown over their clothing, unbuttoned their shirt or blouse, and sat in the reclining chair. Room temperature in the baby-friendly room where the intervention was conducted was maintained at 26° C.

5. When the infant was settled on the mother's chest, the investigators removed the cloth diaper while the mother pulled her clothing and cover gown around the infant. Then the selected lullaby music was played during KC lasted 60 min.

3.6. Data analysis

Recordings were analyzed by one of the authors who had not been involved in obtaining the recordings and did not know whether a recording had been made before or after the music during KC intervention. Descriptive statistics were used to describe the sample's characteristics. Maternal age, way of delivery, gestational age, and infants' body weight were considered as potential confounders. Potential confounding covariates were assessed with Pearson's and Point Biserial correlations. These covariates would include in ANCOVA if their $r > 0.3$ (Cook and Campbell, 1979). Independent t-tests and χ^2 were used to compare the baseline data between groups and over the study period. Each behavioural state was characterized by the frequency of occurrence. Fisher skewness coefficient (z = skewness/standard error skewness; z between $+2.58$) was used to check the normality of variables (Pett, 1997). The distribution of maternal anxiety scores of pretest to day 3 ($z = 1.07-1.62$) met the normality assumption of the parametric statistical tests. To test the hypotheses, repeated measures analysis of covariance (RM-ANCOVA) was used to determine group differences in anxiety scores. Post hoc t-tests with Bonferroni correction were used to determine group differences in anxiety scores at each daily posttest.

4. Results

4.1. Description of mother–infant dyads

In the 9-month recruiting period, 30 eligible mother–infant dyads were included in this study. The 30 mothers ranged in age from 23 to 36 yr (29.27 ± 4.925 yr). All had singleton births and were married, 6 were first-time mothers. The majority were normal spontaneous delivery ($n = 24$, 80%). Sixteen (53.4%) had completed at least Bachelor's degree, and while 10 subjects (33.3%) had high school education. No one had master degree. 27 (90%) were breast feeding.

The mean hospitalization of 30 infants was 8.7 days (range, 3–24 days). Six (20%) were delivered by cesarean section. Mean gestational age on the first day was 33.8 weeks (SD = 2.63, range = 26–36), with a mean weight of 2248 g (SD = 473.10, range = 1505–3285). 27 (90%) of the 30 infants received maternal milk.

4.2. Comparability of groups

Using t-tests and χ^2 test, there were no significant pretest differences between the treatment and control groups in any maternal and infants'demographic data. This indicated that randomization was effective. There were 8 females and 7 males in the experimental group, and 7 females and 8 males in the control group. For the 6 first-time mothers, 4 were in the experimental group, the other two were in the control group. Using t-test, there was no group difference on the pretest state anxiety.

4.3. Maternal anxiety outcomes

The music during KC intervention was effective in improving maternal anxiety. In the music group, there were significant improvements, with a large effect size in anxiety. While controlling for pretest anxiety, repeated measures ANCOVA indicated a significant difference in maternal anxiety scores for group ($F(1, 27) = 28.25$, $p < .001$), and the interaction of group and time ($F(1.49, 40.39) = 5.81$, $p < .01$). The interaction indicated that the effect of music was different among the three time points; anxiety in the treatment group improved the most between the pretest and day1, but continued to improve at day 2 and 3 (Fig. 1), with 50% of the variance in anxiety scores across time associated with the music during KC intervention. Anxiety remained the same in the control group. Post hoc t-tests (adjusted $\alpha = .017$) showed that the treatment group had sig-

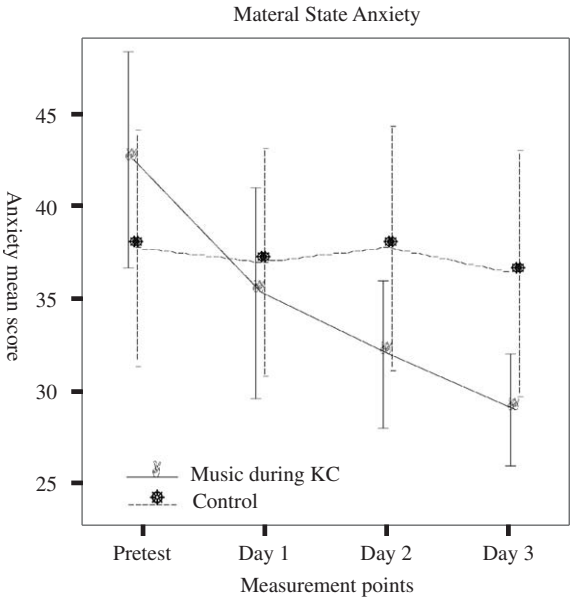

Fig. 1. Maternal anxiety score data from the pretest until day 3.

nificantly lower anxiety scores than the control group at day 3, t (19.6) $= -2.14$, $p < .05$. One-way analysis of variance indicated no significant posttest differences in anxiety scores among the three types of music at day 1, day 2, or day 3.

4.4. Infants' responses

Table 1 shows the difference in O_2 saturation, respiratory rate, and heart rate. Independent t-tests revealed that there was no significant difference between groups at each time point. Behavioural state was recorded every 10 min, yielding 540 observations. Neonates were in quiet sleep during most of the observations (Table 2). In addition, no significant differences in behavioural states were also found between group on day 1 (Table 2). However, the music group had significantly more occurrences on quiet sleep (State 1) ($t = 4.78$, $p < 0.01$) and fewer occurrences on crying (State 6) ($t = -1.97$, $p < 0.05$) then the control group on day 2. The control group had significantly more occurrences on active awake (State 5) ($t = -2.91$, $p < 0.05$) and crying (State 6) ($t = -2.52$, $p < 0.05$) on day 3 then the music group.

5. Discussion

A benefit of the intervention of music during KC is that intervention lessen maternal anxiety. In the present study, there was statistically significant difference on maternal anxiety scores. This finding is similar to a qualitative study reported by Dombrowski et al. (2001), in which KC lower maternal anxiety.

Table 1
Infant characteristics by group ($N = 30$)

Variables	Music during KC ($n = 15$)		Control ($n = 15$)	
	M	SD	M	SD
Day 1				
O_2 saturation	99.00	0.85	98.13	1.85
Respiratory rate	42.87	9.52	43.00	6.95
Heart rate	136.27	7.17	134.13	7.54
Day 2				
O_2 saturation	98.67	0.82	97.80	1.57
Respiratory rate	42.33	7.53	46.40	11.17
Heart rate	138.47	7.21	141.07	11.87
Day 3				
O_2 saturation	98.82	0.88	98.10	1.52
Respiratory rate	43.00	8.23	43.40	8.32
Heart rate	137.31	7.41	136.71	8.35

Note: All $p > .05$.

Evidence in the present study revealed music during KC preterm infants has demonstrated no deleterious physiologic effects in terms of thermoregulation, heart rate, and oxygenation. The findings support the previous research by Bauer et al. (1997) and Legault and Goulet (1995), in which infants' physiologic stability during KC was found. Quiet regular sleep is constantly more frequent during KC and the behavioural state becomes less disorganized from day 1 to day 3 in the present study.

Environmental factors can significantly affect the time spent in different states (Holditch-Davis and Edwards, 1998). Infant behavioural states are disturbed by environmental stimuli, such as bright light, loud noise, cold room temperature, and intrusive procedures (Bernert et al., 1997). Music during KC has had positive effects on infant's behavioural states.

Even though the independent effects of providing KC or of using music have not been investigated in the present study. The present study was methodologically rigorous in design, in recruitment of subjects, and in controlling of the nuisance variables. Further, the current study is the first to provide evidence of the cumulative effect of music during KC on maternal anxiety and to provide a theoretical model for the effects of music during kangaroo care.

5.1. Limitations

Systematic sampling of behavioural state at 10 min intervals was adapted for the whole study period; however, it was not as accurate as continuous measures. Another caution of the interpretation of the study is that blinding of the participants and blinding of the data collector was not practical, resulted in potential source of bias. In experimental studies, a Hawthorne effect is one of the concerns. A Hawthorne effect may have occurred due to maternal awareness of participation in a study; however, babies' behavioural states were reported by nurses.

5.2. Future research

More research is needed to document the effectiveness of music during KC from a father's point of view. Even though the sample size of the study was based on power analysis, considering the difficulty of recruitment, the study did not contain a group who received KC alone. Further study with one more different intervention is also recommended. Furthermore, the independent effects of providing KC or of using music should be investigated.

Table 2
Overall frequency distribution of behavioural states by group ($N = 30$)

Behavioural state	Music during KC ($n = 15$)		Control ($n = 15$)		t
	Mean	SD	Mean	SD	
Day 1					
Quiet sleep	3.87	2.10	2.20	1.93	0.03
Active sleep	1.40	0.99	1.47	0.92	−0.13
Drowsy	0.33	0.49	0.20	0.41	0.81
Quiet awake	0.86	1.12	0.60	1.12	0.65
Active awake	0.40	0.73	0.40	0.82	0.00
Crying	1.06	1.27	0.73	1.03	0.78
Day 2					
Quiet sleep	4.13	0.52	1.80	1.82	4.78**
Active sleep	0.93	1.03	0.60	1.05	0.87
Drowsy	0.53	0.74	0.40	0.51	0.57
Quiet awake	0.53	0.73	0.63	0.79	−0.75
Active awake	0.13	0.40	0.35	0.73	−1.26
Crying	0.40	0.73	1.53	2.09	−1.97*
Day 3					
Quiet sleep	3.06	1.53	2.13	2.35	1.28
Active sleep	0.60	0.73	0.60	0.91	0.00
Drowsy	0.33	0.06	0.48	0.25	1.87
Quiet awake	1.33	0.89	0.86	1.12	1.25
Active awake	0.27	0.45	1.06	0.96	−2.91*
Crying	0.40	1.66	0.82	1.75	−2.52*

*$p < .05$,**$p < .01$, two-tailed.

6. Conclusion

Our findings provide the necessary scientific support to a method that is already incorporated in the care of preterm infants at many hospitals around the world and at different levels of care. Music during KC is a safe intervention and is a remarkably potent intervention against the maternal anxiety preterm infants' behavioural states instability.

Acknowledgements

The research was funded by the Grant no. 91-01 from the Premature Baby Foundation of Taiwan ROC. to Hui-Ling Lai. The authors thank the staff of the Neonatal Intensive Care Unit at Tzu Chi Buddhist General Hospital and Monnonite Christian Hospital for their supports. We also deeply appreciate the families that participated in this study.

References

Bauer, K., Uhrig, C., Sperling, P., Pasel, K., Wieland, C., Versmold, H.T., 1997. Body temperatures and oxygen consumption during skin-to-skin (kangaroo) care in stable preterm infants weighing less than 1500 grams. Journal of Pediatric 130 (2), 240–244.

Bell, R.P., McGrath, J.M., 1996. Implementing a research-based kangaroo care program in the NICU. Nursing Clinics of North America 31 (2), 387–403.

Bernert, G., Siebenthal, K.V., Seidl, R., Vanhole, C.H., Devlieger, H., Casaer, P., 1997. The effect of behavioral states on cerebral oxygenation during endotracheal suctioning of preterm babies. Neuropediatrics 28, 111–115.

Bohnhorst, B., Heyne, T., Peter, C.S., Poets, C.F., 2001. Skin-to-skin (Kangaroo) care, respiratory control, and thermoregulation. Journal of Pediatric 138 (2), 193–197.

Burke, M., Walsh, J., Oehler, J., Gingras, J., 1995. Music therapy following suctioning: four case studies. Journal of Neonatal Nursing 14 (7), 41–49.

Charpak, N., Ruiz-Pelaez, J.G., Figuero, de C.Z., Charpak, Y., 1997. Kangaroo mother vs. traditional care for newborn infants 2000 g: a randomized, controlled trial. Pediatrics 100, 682–688.

Cohen, J., 1988. Statictical Power Analysis for the Behavioral Sciences. Lawrence Erlbaum Associates, New Jersey.

Cook, T.D., Campbell, D.T., 1979. Quasi-Experimentation: Design and Analysis Issues for Field Settings. Houghton Miller, Boston.

Davis, L., Mohay, H., Edwards, H., 2003. Mothers' involvement in caring for their premature infants: an historical overview. Journal of Advanced Nursing 42 (6), 578–586.

Dombrowski, M.A., Anderson, G.C., Santori, C., Burkhammer, M., 2001. Kangaroo (skin-to-skin) care with a postpartum woman who felt depressed. The American Journal of Maternal Child Nursing 26 (4), 214–216.

Elsmen, E., Hansen, P.I., Hellstrom-Westas, L., 2004. Preterm male infants need more initial respiratory support than female infants. Acta Paediatrica 93 (4), 529–533.

Holditch-Davis, D., Edwards, L.J., 1998. Temporal organization of sleep–wake state in preterm infants. Developmental Psychobiology 33, 257–269.

Jones, J., Kassity, N., 2001. Varieties of alternative experience: complementary care in the neonatal intensive care unit. Clinical Obstetrics and Gynecology 44 (4), 750–768.

Lai, H.L., 2004. Music preference and relaxation in taiwanese elderly people. Journal of Geriatric Nursing 25 (5), 286–291.

Lai, H.L., Good, M., 2002. An overview of music therapy. The Journal of Nursing 49 (2), 80–84.

Legault, M., Goulet, C., 1995. Comparison of kangaroo and traditional methods of removing preterm infants from incubators. Journal of Obstetrics, Gynecologic, and Neonatal Nursing 24 (6), 501–506.

Marwick, C., 2000. Music hath charms for care of preemies. Journal of the American Medical Association 283 (4), 468–469.

Miles, M.S., Holdtch-Davis, D., Shepherd, H., 1998. Maternal concerns about parenting: prematurely born children. The American Journal of Maternal/Child Nursing 23 (2), 70–75.

Neu, M., 1999. Parents' perception of skin-to-skin care with their preterm infants requiring assisted ventilation. Journal of Obstetric, Gynecologic, & Neonatal Nursing 28 (2), 157–164.

Pett, M.A., 1997. Nonparametric Statistics for Health Care Research: Statistics for Small Samples and Unusual Distributions. Thousand Oaks, California.

Premature Baby Foundation of Taiwan R.O.C., 2004. The incidence of prematurity. Available at: http://www.pbf.org.tw/index_e.htm, accessed October 20.

Shek, D.T.L., 1988. Reliability and functional structure of Chinese version of the state-trait anxiety inventory. Journal of Psychopathology and Behavioral Assessment 10, 303–317.

Shek, D.T.L., 1993. The Chinese version of the State-Trait Anxiety Inventory: its relationship to different measures of psychological well-being. Journal of Clinical Psychology 49, 349–358.

Sloan, N.L., Camacho, L.W.L., Rojas, E.P., Stern, C., 1994. Kangaroo mother method: randomized controlled trial of an alternative method of care for stabilized low-birthweight infants. Lancet 344, 782–785.

Smith, S.L., 2001. Physiologic stability of intubated VLBW infants during skin to-skin care and incubator care. Advances in Neonatal Care 1, 28–40.

Spielberger, C.D., 1983. Manual for the State-Trait Anxiety Inventory. SATI (Form Y). Palo Alto, Consulting Psychologist Press Inc., California.

Spielberger, C.D., Diaz-Guerrero, R., 1983. Cross-Cultural Anxiety. Hemisphere, Washington.

Standley, J.M., 2002. A meta-analysis of the efficacy of music therapy for premature infants. Journal of Pediatric Nursing 17 (2), 107–111.

Standley, J., Moore, R., 1995. Therapeutic effects of music and mother's voice on premature infants. Pediatric Nursing 21 (6), 509–512.

Stevens, J., 1996. Applied Multivariate Statistics for the Social Sciences. Hillsdale, Lippincott, New Jersey.