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The difference of quiet sleep duration about low birth weight (lbw) babies carried out by kangaroo care by father and mother

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Abstract---Background: Sleep disturbances experienced by low birth weight baby may disrupt the process of neural development and maturity of the babies' brain due to various stimuli during their care. To date, kangaroo care is only performed by the mothers. The purpose of this study was to identify the difference of quiet sleep duration about low birth weight (LBW) babies carried out by kangaroo care by father and mother. Methods: The research design was post test-only nonequivalent control group using a consecutive sampling technique with 16 respondents of low birth weight babies hospitalized in three hospitals in Aceh. Kangaroo care (KC) was carried out for at least 60 minutes or until the parents/babies don't want to anymore. Video recording of the baby was taken 15 minutes after the KC sling was installed and lasted for 60 minutes. Statistical analysis using Paired t-test. Results: There was no significant difference between the duration of quiet sleep of LBW babies given kangaroo care performed by fathers and mothers (p-value 0,77). Conclusion: Kangaroo care can be done by either fathers or mothers so that the emotional attachment between babies and their mother or father will be deepened, quiet sleep period of LBW babies will be extended, and can be continued at home with their family support.

Keywords---kangaroo care, low birth weight baby, quiet sleep.

Introduction

Babies with low birth weight (LBW) are vulnerable to various health problems due to immature organs LBW infants and require treatment in a hospital. LBW will experience various stimuli that can cause stress and sleep baby (Allen, 2012; Chaudhari, 2011; Teklehaimanot, 2014). This condition will result in disruption of the baby's brain nerve development (Graven & Browne, 2008). Periods of sleep should not be disturbed for at least 50 minutes to allow optimal sleep cycles (Hockenberry & Wilson, 2015) because during quiet sleep there is a process of neurosensory system in the brain and the release of growth hormones that support the growth and development of infants (Leger et al., 2015).

Sleep in LBW is often identified by short sleep periods, indistinguishable sleep status, and shorter duration of restful sleep compared to normal weight infants (Holditch-Davis, 1990). This is because LBW has difficulty in facing challenges in the first week of life due to immature innervation. Some studies suggest that kangaroo care has been shown to increase the length of quiet sleep of LBW (Begum et al., 2008; Ruth Feldman et al., 2002; Ferber & Makhoul, 2004; Ludington-Hoe et al., 2006; Saidah et al., 2011).

So far, kangaroo care is only been done by mothers, fathers have not played much role. While father's participation is very important in providing family centered care. In addition, father's body temperature tends to be more stable than the mother's body temperature because it is influenced by the smaller body mass of women than men, so that the heat loss through convection is greater than that of men (Garrett & Kirkendall, 2000); and basal metabolic rate (BMR) in men also increased compared to women because of the influence of the male hormone testosterone which can increase BMR, so that men's body temperature tends to be hotter than women (Braine, 2009). Furthermore, according to (Santrock, 2011), it is easier for fathers to put babies to sleep than mothers. This shows that the father can stabilize the infant's body temperature faster and make the infant fall asleep faster so that it can facilitate the infant in reaching the quiet sleep.

The continuity of kangaroo care (KC) requires support and dedication from various parties such as the hospital and the fathers support. In order for the implementation of KC to continue at home, parents should be given health education, which is carried out gradually so that parents, especially fathers, can also play a role in the care of the kangaroo method. However, what is happening now that the infant's parents are given the health education when the infant is coming home already (Rustina et al., 2016). In terms of nurses, the problem that occurs was that nurses have limited time, limited learning media which causes inconsistent health education. Meanwhile, the problem in terms of parents was the lack of educational program about the implementation of kangaroo care, difficulties in obtaining information and topics needed by parents and follow-up on kangaroo care at home. Therefore, family involvement, in this case the father, was important in implementing kangaroo care as well as to facilitate the infants's growth and development. Based on the background as mentioned earlier, this study aimed to further identify the difference of quiet sleep duration about low birth weight (LBW) babies carried out by kangaroo care by father and mother.

Methods

Study design: The design used in this study was a quasi-experimental with a posttest-only nonequivalent control group design.

Sample size: The sample which taken by using consecutive sampling technique with a total of 16 LBW and carried out twice the KC intervention by the father and mother. The inclusion criteria for low birth weight who became respondents were infant weight <2500 grams, stable condition (body temperature 36,5°C-36,2°C, breathe spontaneously), do not use mechanical ventilation, no convulsions and diarrhea, no congenital abnormalities, father and mother willing to do kangaroo care. Whereas exclusion criteria include respiratory distress syndrome, undergoing phototherapy, and has a congenital heart disease.

Studi setting: This research was conducted in the NICU Room at dr. Zainoel Abidin Aceh, Maternal and Child Hospital Banda Aceh, Meuraxa Hospital Banda Aceh City.

Instrument

The data collection tools in this study were the standard operational procedures for the kangaroo care, the observation sheet for waking sleep behavior which contained the characteristics of the respondent (infant weight, gestational age, age at study, and gender of the infant), the assessment of quiet sleep adapted from Brazelton and Nugent (1995) (which contained of quiet sleep, active sleep, drowsiness, quiet awake, active awake, and crying) and using a video recorder to make it easier for researcher to observe LBW sleep duration. The validity and reliability of the instrument was carried out using the Bland-Altman test to assess the suitability of the two observers to the observation of low birth weight sleep by kangaroo care by the father and mother. The Bland-Altman test results obtained 0.81 which means that the observers have good reliability/suitability.

Statistical analysis

The data in this study were analyzed using univariate and bivariate analysis with a computer program. Univariate analysis of the characteristics of the respondents including gender was presented in percentage form, while gestational age, body weight and age at the time of the study were presented in mean form. The length of quiet sleep of LBW during KC by father and mother was presented in mean form. Bivariate analysis to assess the difference in the length of quiet sleep LBW during KC performed by fathers and mothers using the paired t test.

Procedure

Data collection steps included identifying infants according to inclusion and exclusion criteria. Researchers contacted the parents of prospective respondents to explain about kangaroo care and research procedures and asked for the consent of the respondents' parents. The baby was placed on the mother/father's chest without wearing clothes in an upright position, the head was slightly tilted towards one side and both legs and hands in a flexi position. Then the researchers put on a kangaroo cloth and a warm hat. Mother/father sat in the space provided. Researchers took the kangaroo care video of the baby 15 minutes

after kangaroo care sling so that the baby could adapt. The recording process for 60 minutes while kangaroo care progress. The implementation of kangaroo care was first carried out by the mother and the next day by the father. All mothers do KC in the morning at the hospital while KC by fathers was done in the afternoon. Kangaroo care can be continued until the baby or father/mother does not want anymore. The infants's body temperature, heart rate and respiratory rate were measured 15 minutes after placing the sling and after the kangaroo care was completed. The results of the recording were assessed after the procedure was completed by two observers, namely the pediatric nurse specialist by blind observation. The first observer assessed the LBW baby's quiet sleep duration which was carried out by kangaroo care by the mother, while the second observer assessed the duration of the LBW baby's quiet sleep which was carried out by kangaroo care by the father.

Ethics

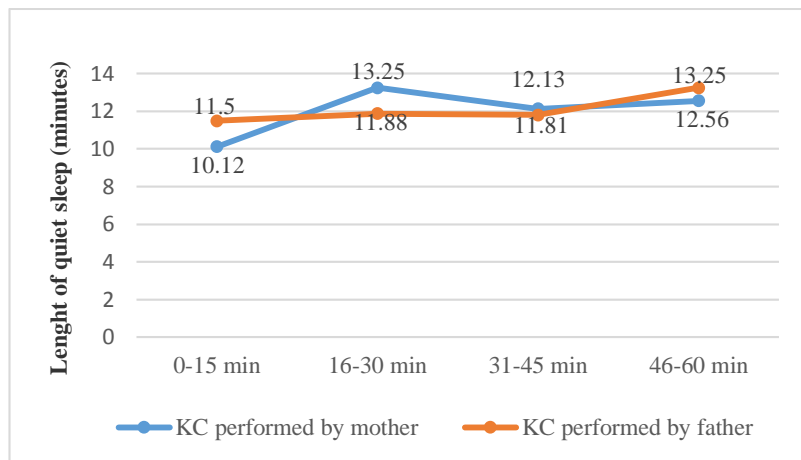
This study was approved by the Ethical Committee of the Nursing Faculty of Indonesia University prior to collection of data with the ethical approval number is No.0374/UN2.F12.D/HKP.02.04/2016.

Results

Table 1
Respondent characteristic (n=16)

Variable	f (%)	Mean	SD	Range
Birth weight (gram)		1703.13	369.12	1180-2300
Gestasional age (week)		35.75	2.27	32-40
Postnatal age (days)		10.56	7.95	2-33
Gender				
Boy	7			
Girl	(34.75)			
	9			
	(56.25)			

Respondent characteristics consist of infant weight, gestational age, age at study, and gender. The mean weight of infants in this study was 1703.13 grams with an average gestational age of infants of 35.75 weeks. The age of infants at the time of the study was at a median of 7.5 days and the majority of LBW sex were girls (56.25%).



Graph 1: LBW Quiet Sleep Duration for 60 minutes

Graph 1 shows the difference in the duration of low birth weight quiet sleep during the observation of KC implementation by the father and mother at 0-15 and 16-30 minutes. However, in the next minute, it did not look much different from the length of LBW sleep performed by the father and mother.

Table 2
Difference of quiet sleep of LBW during kangaroo care by father and mother (n=16)

Variable	Mean (minutes s)	SD	Range	p- value
Length of quiet sleep of LBW during kangaroo care by father	48.44	4.75	45.91-50.97	0.77
Length of quiet sleep of LBW during kangaroo care by mother	48.06	5.77	44.99-51.14	

The total duration of LBW quiet sleep during the implementation of kangaroo care performed by the father was 48.44 minutes (SD 4.75) and mother was 48.06 minutes (SD 5.77). Further analysis with the Paired t-test showed that there was no significant difference between the mean length of quiet sleep of low birth weight kangaroo care performed by father or mother ($p = 0.77$; $\alpha = 0.05$).

Discussion

The average weight of the babies in this study was 1703.13 grams. Baby's weight can affect the baby's ability to achieve quiet sleep. Babies with low birth weight have limitations in achieving quiet sleep compared to babies with normal weight because of the immaturity of neural function. Maturity of innervation can be indicated by the baby's ability to regulate sleep (Fallon, 2015) because at this time

there is an improvement in the function of body cells and the release of one of the body's hormones, namely growth hormone which was secreted at the beginning of the quiet sleep period and was inhibited during active sleep (Widodo & Soetomenggolo, 2000).

The LBW gestational age in this study showed an average of 35.75 weeks. Gestational age can affect a baby's sleep. The higher the gestational age, the more the quiet sleep phase and the less active sleep phase. This was in accordance with the research of (Werth et al., 2017) showed that infants with gestational age <30 weeks experienced fewer quiet sleep phases and more active sleep phases. Meanwhile, infants with gestational age >34 weeks were more in the quiet sleep phase and had less active sleep.

Furthermore, the median age of the infants at the time of this study was 7.5 days. Newborns will usually spend their time sleeping. According to Bowden & Greenberg (2010), the average length of sleep for babies in the first week of birth is 16-20 hours over a 24-hour period. Every newborn sleep cycle occurs for 60 minutes with 20 minutes of quiet sleep and 40 minutes of active sleep (Ludington-Hoe et al., 2006). Research by Horne et al., (2000) showed that the duration of active sleep in 36 weeks gestational age infants without KC intervention in each sleep cycle was 32 minutes of active sleep and 27 minutes of quiet sleep. The next measurement at the age of 2-3 weeks showed that the baby spent 30 minutes of active sleep and 22 minutes of quiet sleep. Meanwhile, in this study, the duration of quiet sleep for LBW babies during KC implementation reached 48 minutes. This allowed LBW to achieve a longer quiet sleep and tended to be the same as normal weight babies so that the fulfillment of LBW quiet sleep can be achieved through the implementation of KC.

The results of this study indicated that there were more girl babies than boy babies (56.25%). Bach et al., (2000) found that boy infants slept significantly less, tended to have longer active sleep and less restful sleep than girl infants. This statement was also strengthened by the results of research by Foreman et al., (2008) that boys experience less sleep, sleep more, wake up more than girl babies. The maturation of the central nervous system appeared to be faster in baby girls than in boys (Thordstein et al., 2006). However, this cannot be separated from other factors, namely gestational age and baby's weight which can also affect the baby's quiet sleep duration.

The duration of LBW quiet sleep performed by KC by the father and mother at 0-15 minutes for 11.5 minutes and 10.12 minutes. Researchers assumed that the difference in the duration of quiet sleep at 0-15 minutes and 16-30 minutes was related to the adaptation process of infants from the incubator environment to the mother/father's body. In the next minute, it can be seen that the length of sleep for infants performed by KC by mothers and fathers was not much different. This was because the infant has adapted and feels comfortable in the arms of the father /mother. The average duration of quiet sleep during KC by the father appeared to be more stable and increased in 40-60 minutes compared to during KC by the mother. Overall, the LBW baby's performed by KC by fathers and mothers were more in the quiet sleep phase compared to active sleep, sleepiness, quiet awake, active awake, or crying.

In this study, it was found that in the 0-60 minutes of KC carried out by the father or mother, it was seen that the quiet sleep phase of LBW tended to increase, while the active sleep phase and sleepiness tended to decrease in LBW both at the time of KC carried out by the father or mother. This study is in accordance with research conducted by Begum et al., (2008) and Feldman et al., (2002) who stated that infants who were treated with KC appeared to spend more time in the quiet sleep phase than active sleep. An increase in quiet sleep and a decrease in active sleep was evidence of the development and maturity of the infant's brain (dos Santos et al., 2014). Achieving quiet sleep at LBW was important because babies with low birth weight have limitations in achieving quiet sleep compared to normal weight babies due to immature innervation (Fallon, 2015). In addition, gestational age also affected the sleep of the baby. Research by Werth et al. showed that infants with gestational age <30 weeks had less quiet sleep phases than > 34 weeks' gestation (Werth et al., 2017). So that, Kangaroo care can facilitate LBW to achieve quiet sleep so that the process of growth and development of LBW optimally.

In addition, the consumption of oxygen and calories during KC was at the lowest levels, infants also show less physical activity and use of energy. This happened because babies were mostly in a quiet sleep phase which was characterized by a decrease in peripheral vascular tone and arterial blood pressure, a decrease in pulse rate, and the muscles experience a state of complete rest (Guyton, 2014). Therefore, the available energy can be used for the growth and development of the infant. Physical activity such as shock can often be seen when the infant is in an incubator. This situation will increase the energy and oxygen consumption of the infant. This was due to an increase in workload which was directly proportional to oxygen demand and energy availability for muscle activity and heat production (Bobak et al., 2012). However, infants who were treated with KC were not surprised because the infant felt comfortable in the mother/father's arms and the threshold for stimulation was higher when the infant was sleeping quietly so that only high-intensity disturbances could wake the infant. Skin-to-skin contact can also stimulate endogenous mechanisms that function to suppress the pain response so that the baby felt calmer (Bobak et al., 2012). This condition can increase the duration of LBW's quiet sleep.

The results of this study indicated that the mean duration of quiet sleep of LBW during KC by the father and mother did not differ significantly. This may be due to environmental factors during KC implementation. Most of the KC by fathers (75%) was done at home while KC by the mother was all done in the hospital. The home environment made babies and parents felt more comfortable and reduces parental anxiety about their babies because the infant was stable compared to when their infant was cared for at home. Likewise, with LBW who felt comfortable because they have been free from various medical and nursing actions that make infants may experience stressful conditions. This made the LBW baby's quiet sleep during the implementation of KC by the father was a little longer than the KC carried out by the mother. The home environment was positively related to the involvement of fathers in infant care. Tessier et al., (2009) identified that KC has a positive impact on the home environment because fathers are required to be directly involved in caring for babies during KC and stimulate better parenting

KC facilitates direct skin-to-skin contact between father/mother and baby. During KC, the baby was placed on the mother's/father's chest in a prone position and covered with clothes. This condition allowed the intensity of skin-to-skin contact and fulfills the needs of the baby and mother/father for warmth, love, and the attachment of the parent-child relationship (Gabriels et al., 2015). In addition, KC also includes elements of detention, namely the baby is placed on the mother/father's chest, under the blanket, and with the mother/father's hand holding the baby. This element can evoke calm and induce restful sleep and reduce the active sleep phase (Ludington-Hoe et al., 2006).

The results of the paired t test showed that there was no significant difference between the average length of quiet sleep of LBW babies carried out by KC by the father or mother. This showed that KC can be done by mothers or fathers because they both provide comfort for the baby. (Srinath et al., 2016) conducted a study comparing the physiological and stress responses of 26 infants by KC by father and mother. The results showed that there were no differences in the physiological and stress responses of infants by KC by father and mother.

KC can be performed by mother or father. The father can replace the mother when the mother felt tired. Support and the role of the father was needed, especially in the first year of the infant's birth. Fathers can be an important source of emotional support in newborn care (Sadeh, 2001). When infants were admitted to the NICU, not only mothers felt stress, but fathers also felt the same way regarding their role as parents. The risk of delayed attachment between parent and infant was higher when their infant is cared for. This will be controlled if the father was involved in the care of newborns with high risk such as LBW (Shorey et al., 2016). The involvement of fathers in the implementation of KC can facilitate fathers' participation in their babies and make fathers have a role as parents, as well as make fathers more active during the first year of the baby's birth.

Based on research by Erlandsson et al., (2007) on 29 fathers and their babies, it was identified that skin-to-skin contact between father and baby during the first 2 hours after birth had a positive impact on the baby's crying behavior. Analysis of video recordings of crying babies showed that babies in KC cried less than babies who were only placed in cribs. In addition, babies placed on the father's chest at the time of KC fell asleep more quickly at 60 minutes after birth, while babies placed on the bed fell asleep at 110 minutes after birth. Another study by Valera et al., (2014) showed that fathers who did kangaroo care had higher sensitivity (including empathy, and gave appropriate responses) and showed caring behavior than fathers who did not do KC. This showed that early skin-to-skin contact in the implementation of KC can increase the involvement of fathers in caring for their babies.

Kangaroo care provided a positive emotional and physical experience for parents, parents feel more comfortable, motivated to be more involved in their baby's care, increase self-confidence, provide peace of mind, and strengthened the role of parents as the main caregivers of their babies (Gabriels et al., 2015). According to Fallon (2015), more frequent skin-to-skin contact between mother/father and baby can increase interaction between mother/father and baby.

Parent-infant interaction was very important for LBW babies because LBW babies were more passive and less socially responsive and had great difficulty in interacting and maintaining social interactions. Health complications associated with prematurity require the infant to be admitted to the NICU room. This is a factor that contributes to the mismatch of interactions between infants and parents where infants were more prone to stress due to the amount of treatment / stimulation felt by the infants (Schwichtenberg et al., 2011). Apart from the prematurity factor, the quality of parental interactions was crucial to the development and ability of LBW in self-regulation, cognitive abilities, and behavioral problems. At the beginning of birth, LBW was at risk of experiencing stress easily, much stimulation than normal infants, and they were also less active and less responsive (Schwichtenberg et al., 2011). Feldman et al., (2014) on 73 infants who were subjected to KC showed that KC improved attachment relationships, reduced anxiety, and babies slept longer.

Thus, KC carried out by fathers or mothers on LBW both provide comfort for LBW and make LBW's restful sleep longer. The kangaroo method of care intervention was actually an easy treatment for mothers or fathers to do either in the hospital or at home. This becomes important as an effort to minimize the side effects of using medical devices for babies with low birth weight and KC also to strengthen the bonding attachment between babies and parents.

Therefore, the results of this study were beneficial as input for health services so that the implementation of KC can be more optimized because the benefits for infants that are obtained from KC were vary. One of them was to facilitate LBW for a longer peaceful sleep. Infants need quiet sleep to grow and develop because in this phase there was energy savings and the release of growth hormones and sleep can accelerate the maturity of the infant's brain. Sleep was one of the parameters for assessing the maturity of the central nervous system. In addition, nurses needed to facilitate the implementation of KC both by mothers and fathers by providing themselves with various related trainings. Obstacles in implementing KC, especially by fathers, can be reduced by providing a special room for KC in the hospital.

The limitation in this study was that the researcher has to collect data on several respondents by KC by the father in his own house because only one hospital has a special room for KC, while the other two hospitals have only NICU rooms and only mothers can do KC. This was an obstacle for fathers who want to do KC and fathers were only allowed to visit their babies, so researchers must conduct research on KC which was carried out by fathers at the respondent's own house in the afternoon after the father returns from work.

Conclusion

In conclusion, there was no difference in the length of quiet sleep LBW performed by KC by the father and that done by KC by the mother. That means, fathers were equally important in facilitating infants to sleep peacefully. Hospitals need to facilitate the implementation of KC by providing a special room for KC so that KC was not only carried out by the mother but also by the father while the child was

still being treated in the hospital. There needs to be further research on the experience of fathers who do KC.

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