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Original Article

Effect of kangaroo method on the risk of hypothermia and duration of birth weight regain in low birth weight infants: A randomized controlled trial

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Abstract

Background In Indonesia, the infant mortality rate in 2001 was 50 per 1000 live births, with 34.7% due to perinatal death. This perinatal death was associated with low birth weight (LBW) newborn, which was caused by prematurity, infection, birth asphyxia, hypothermia, and inadequate breast feeding. In developing countries, lack of facilities of LBW infant care leads to the utilization of kangaroo method as care to prevent hypothermia in LBW newborn.

Objective To evaluate the differences of hypothermia event and duration of birth weight regain in LBW newborns between early kangaroo care (EKC) and conventional care (CC).

Methods This was an open label randomized controlled trial. The 1500-2250 g LBW newborns who were born in Sanglah Hospital were randomized to EKC and CC groups.

Results Hypothermia events were found more often in CC group than EKC group (RR=0.645, 90% CI 0.45 to 0.92, P=0.05). This difference was influenced by breast feeding frequency. Duration of birth weight regain in EKC group (median 5 days (SE=0.31, 90% CI 4.49 to 5.51) was shorter than CC group (median 6 days (SE=0.52, 90% CI 5.15 to 6.85), but this difference wasn't statistically significant (P=0.40). Percentage of birth weight decrease, breastfeeding frequency, and hyperbilirubinemia events that needed phototheraphy were associated with the duration of birth weight increase.

Conclusion EKC helps to decrease the incidence of hypothermia events, but fails to shorten duration of birth weight increase. Percentage of birth weight decrease, breast-feeding frequency, and hyperbilirunemia events that need phototheraphy are associated with the duration of birth weight increase in LBW newborn. **[Paediatr Indones. 2009;49:253-8]**.

Keywords: *low birth weight infant, kangaroo method, birth weight regain, hypothermia*

The infant mortality rate (IMR) in Indonesia, in 2001, was 50 infants per 1000 live births and 34.7% was due to perinatal death.[1] Perinatal death was associated with low birth weight newborn,[2] which were caused by prematurity, infection, birth asphyxia, hypothermia, and inadequate breast feeding.[3] In the first days of life, birth weight will decrease then it regains in 10-20 days. Excessive loss of birth weight can make hypernatremia dehydration.[4] Bertini et al[5] reported that there was a relationship between hyperbilirubinemia and percentage of birth weight decrease.

In Indonesia, there are lack of facilities for low birth weight (LBW) infant care,[2] therefore kangaroo mother care is one of the choices to prevent and treat hypothermia in newborn. Early kangaroo care (EKC) is a type of kangaroo mother care which is performed in stable newborn, and it begins in the first day or in several hours after birth;[6] this method is considered

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as a humanized care in treating LBW newborn. The aim of this study was to explore whether EKC reduced hypothermia event and duration of birth weight regain in LBW newborn.

Methods

This study was conducted in Sanglah Hospital, Denpasar, Bali, Indonesia, from February 1st, 2007 to April 30th, 2008. We conducted a randomized controlled trial by comparing newborns with EKC and conventional care (CC) in hypothermia events and duration of birth weight regain. Written informed consent was obtained from parents. Ethical approval for this study was granted by The Committee for Medical Research Ethics of Medical School, Udayana University. We calculated sample size using hypothetical test formula in two proportions, with α = 10%, β = 20% and 10% was added to sample size to anticipate lost to follow up. Therefore, 49 LBW newborns were included in this study. We used block randomization with block size of 6, to divide subjects into EKC group or CC group. Birth weight was stratified to 1500-1750 g and > 1750-2250 g. The inclusion criteria of the newborns were 1500-2250 g LBW newborns who were born in Sanglah Hospital, Denpasar, Apgar score > 6 at 5 minutes, mother of the subject were willing to follow this study and signing informed consent. The newborns were excluded if their mother had history of drug abuse, psychiatric disorders, mothers who were unable to take care of themselves or their babies, mother with caesarean section, major congenital malformation which was unintentionally found during regular examination, twin LBW newborns, LBW newborns with complicated pregnancy and/or labour, newborns with cardiopulmonary problems, and critically ill (sepsis, necrotizing enterocolitis, intracranial bleeding).

An electric digital thermometer (Geon MT B261) and a weight scale (Soenhnle Baby Scale^R) were used for temperature and body weight measurement, respectively. The electric digital thermometer could reach 32^{o}C with SD of 0.2^{o}C accuration in body temperature < 35^{o}C and SD of 0.1^{o}C in body temperature between 35^o to 42^{o}C. The weight scale had 10.5 kg capacities with 10 g accuration. Specially tailored kangaroo suits worn by mother-baby pairs were included in the kangaroo group. The suits enabled the baby to have a close skin-to-skin contact with the mothers whilst in vertical position. Meanwhile, the babies in the CC group received standard care (incubator or open care system).

Statistical analysis was done using computer program. Chi square test or Fisher's exact test was used to compare hypothermia event between EKC and CC group. Unpaired t test or Mann-Whitney U test was used to compare the duration of birth weight regain between two study groups. Kaplan-Meier test was also used to compare the duration of birth weight increase between two study groups. Factors influencing the outcome were tested by multivariate analysis (cox regression).

Results

There were 576 LBW newborns born in Sanglah Hospital from February 1st 2007 to April 30th 2008. LBW newborns with birth weight 1500-2250 g were 267 newborns. A total of 98 newborns fulfilled inclusion and exclusion criteria, where as four newborns were excluded later because of sepsis and one was lost to follow up.

Characteristics of the groups study are depicted in **Table 1**. Mean birth weight for EKC group was 2033.75 g (SD 159.34 g), and for CC group was 1987.78 g (SD 176.06 g). Mean gestational age for EKC group was 35.63 weeks (SD 2.27) and for CC group was 35.53 weeks (SD 2.31).

Hypothermia events were more prevalence in CC (47%) than EKC group (27%) (RR=0.645, 90% CI 0.45 to 0.92, P=0.05). Relative risk reduction was 42%, absolute risk reduction was 20%, and number need to treat was 5. Logistic regression test to confounding variables for hypothermia events found that hypothermia events were not only influenced by treatment being studied but also frequency of breast feeding per day (**Table 2**).

Mean duration of kangaroo mother care being done in that group was 10.06 hours (SD 1.75, range 5.33 to 13.5 hours).

Duration of birth weight regain in EKC group (median 5 days (SE=0.31, 90% CI 4.49 to 5.51)

Table 1. Characteristics of LBW infants in EKC group and CC group

Characteristics	EKC group (n=48)	CC group (n=45)
Birth weight		
a. 1500-1750 g	4	4
b. > 1750 – 2250 g	44	41
Gestational age:		
> 36 weeks	16	19
33-36 weeks	28	22
< 33 weeks	4	4
Gender:		
male	14	26
female	34	19
Mean Family income:		
< Rp 500.000,00	7	8
Rp 500.000,00 – Rp 2.000.000,00	39	37
> Rp 2.000.000,00	2	0
Mothers education:		
a. Elementary or no education	12	16
b. Junior & senior highschool	34	29
d. Higher education	2	0
Mother age:		
a. < 20 years old	3	2
b. 20-30 years old	35	34
c. >30-35 years old	10	9
Modes of delivery:		
a. spontaneous delivery	47	43
b. operative vaginal delivery	1	2
Types of LBW newborns:		
a. Appropriate for gestational age	34	26
b. Small for gestation age	14	19

was shorter than in CC group (6 days (SE=0.52, 90% CI 5.15 to 6.85). After using Kaplan Maier survival analysis (log-rank test, P=0.40) and Mann-Whitney U test (P=0.224), this difference was not significant. Outcome of duration of birth weight increase for two groups is presented in **Figure 1**.

Multivariate analysis (Cox regression) was done to find out variables that influenced the duration of birth weight increase. Duration of birth weight increase was influenced by percentage of decreasing birth weight, frequency of breastfeeding per day, and hyperbilirubinemia events that needed phototheraphy (**Table 3**).

Percentage of decreasing birth weight was found greater in CC group (mean 4.33%, SD 3.30) than in EKC group (mean 3.44%, SD 2.95) but this difference was not statistically significant (90% CI 1.97 to 0.19, P=0.173). Hyperthermia events were found greater in CC group than in EKC group but this difference was not statistically significant (RR=0.755, 90% CI 0.54 to 1.06, P=0.515). We found one sepsis newborn in EKC group and three in CC group (RR 0.49, 90% CI 0.21 to 1.13, P=0.617). Hyperbilirunemia events that needed phototherapy in EKC group were lesser than in CC group but this difference was not statistically significant (RR=0.78, 90% CI 0.55 to 1.09, P=0.443). There were no newborns who passed away in this study.

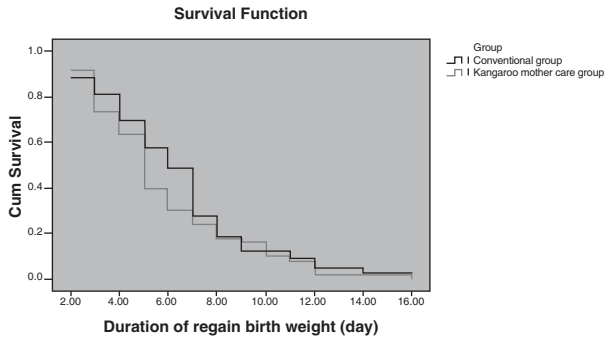

Figure 1. Kaplan-Meier survival curve for duration of birth weight regain for kangaroo mother care group and conventional group

Table 2. Relation among variables that influenced hypothermia events

Variables	B	S.E.	P	Exp(B)	90% CI for EXP(B)	
					Lower bound	Upper bound
Birth weight	0.309	0.922	0.738	0.734	0.161	3.347
Gestational age	0. 206	0.585	0.724	1.229	0.470	3.218
Frequency of breast feeding/day	-0.117	0.070	0.093	0.889	0.793	0.998
Using parenteral nutrition	1.481	1.342	0.270	4.396	0.483	39.991
Volume of breast milk/Formula milk (ASI)	-0.006	0.004	0.154	0.994	0.987	1.001
Mean of environment temperature	-0.755	0.714	0.290	0.470	0.145	1.520
Treatments being study	-1.071	0.557	0.054	0.342	0.137	0.856
Types of LBW newborns	-0.217	0.744	0.771	0.805	0.237	2.737

Table 3. Relation among variables that influenced duration of birth weight regain.

Variables	B	SE	P	Exp(B)	90% CI for Exp(B)	
					Lower bound	Upper bound
Birth weight	-0.295	0.424	0.487	0.745	0.370	1.497
Gestational age	0.233	0.326	0.475	1.262	0.738	2.159
Hypothermia events	0.050	0.249	0.842	1.051	0.698	1.583
Hyperthermia events	-0.034	0.394	0.931	0.966	0.505	1.849
Percentage of decreasing birth weight	-0.361	0.060	0.000	0.697	0.632	0.769
Frequency of breast feeding/day	-0.054	0.032	0.091	0.947	0.898	0.998
Using parenteral nutrition	-0.281	0.665	0.673	0.755	0.253	2.256
Volume of breast milk/Formula milk (ASI)	-0.001	0.002	0.794	0.999	0.996	1.003
Types of LBW newborns	0.108	0.382	0.777	1.114	0.594	2.088
Treatments being study	-0.206	0.254	0.417	0.814	0.536	1.235
Hyperbilirubinemia	1.149	0.386	0.003	3.155	1.672	5.953

Discussion

A descriptive study of kangaroo mother care in newborns (birth weight $\leq$ 1750 g) conducted by Lima et al[7] in Brazil revealed that hypothermia events occured at 30 episodes per 100 days, mainly when the newborns were separated transiently from their mothers. Hypertermia with unclear etiology was occured in one episode in one newborn. A study that observed temperature continuously, suggested that kangaroo mother care could reduce hypothermia risk > 90% if compared to conventional care (RR=0.09, 95% CI 0.03 to 0.25). Hyperthermia was also found in kangaroo mother care but the difference between the two methods was not significant.[8] A study about efficiency of kangaroo mother care in regulating < 2000 g newborns body temperature conducted by Ndiaye et al[9] suggested that kangaroo mother care could stabilize body temperature in the range of 36.5°-37.5°C. The pre-post test study by Chwo et al[10] who compared tymphani temperature of the newborns with and without kangaroo mother care suggested mean of tymphani temperature was higher when the babies were cared using kangaroo mother care than without using kangaroo mother care (37.3°C vs 37.0°C). In this study, we did not use hypothermia events based on episodes of hypothermia but number of newborns being hypothermia. Hypothermia events were more frequent in CC group than EKC care group (RR=0.645, 90%CI 0.45 to 0.92, P=0.05) with NNT 5 (to reduce one hypothermia event, need five newborns to be treated). This finding is consistent with studies above that suggest decreasing hypothermia event with the kangaroo mother care. By using kangaroo mother care, mother breast temperature is in accordance with newborn neutral environment temperature,[11] while if newborns in incubator, if they are not well monitored, the newborns may become hypothermia or hyperthermia.[12] LBW newborns > 2000 g are often treated in open care system. In this situation, the babies sleep alone and if there are weather changes (e.g. become cold), the babies become hypothermic.

In this study, hypothermia events were influenced not only by treatment being studied but also frequency of breast feeding/day. It might be caused by giving baby breast milk, the baby would be carried in mother arms, there was a close contact, so the baby was also warmed. But this finding must be confirmed by others study.

A study by Penalva and Schwartzman[13] on LBW newborns (mean birth weight 1560 g, SD=269 g) using kangaroo mother care, found that the mean duration of birth weight regain was 16.7 days (5-33 days, SD 5.9). In this study, we found median duration of birth weight regain were 5 days (SE=0.31, 90% CI 4.49 to 5.51) for EKC group and 6 days for CC group (SE=0.52, 90% CI 5.15 to 6.85). This finding is not consistent with the latter study. It might be caused by the difference of birth weight between our study and the latter study. We were using subjects with birth weight 1500-2250 g. Duration of birth weight increase in our study is concomitant with other study that used newborns with birth weight 1418-2077 g,[14] although the interventions were different from our study (influence of different sugar). Probably there is a relationship between difference of birth weight and duration of birth weight regain. However, this finding needs to be explored profoundly later.

Chwo et al[10] reported that there was no difference between kangaroo care dan control care in decreasing birth weight. Bertini et al[5] found tight relationship between hyperbilirubinemia (total serum bilirubin more than 12.9 mg/dL) and percentage of birth weight decrease. Macdonald et al[15], who conducted a study on newborns of more than 2000 g, found that weight loss for breastfed infants was greater than for formula fed infants (median : 6.6% vs. 3.5%). In this study, we found percentage of birth weight decrease were 4.33% for CC group and 3.44% for EKC group, but this was also not statistically significant. Duration of birth weight increase was influenced by percentage of birth weight decrease, frequency of breast feeding/day, and hyperbilirubinemia events that needed phototheraphy. This findings are similar to the latter studies. Excessive birth weight decreased due to fasting has a relationship with neonatal icteric. Increase of enterohepatic cycle is the major factor in pathogenesis of fasting which causes hyperbilirubinemia.[5]

P value in our study was 0.1. As a consequence of that, our study has type 1 fault which is 10%. We couldn't do blinding in our study, so there could be bias from the researcher or evaluator. Feeding given by mother or nurse became more intensive following this study. It was also influencing the result. The control group in our study is a conventional care group which used incubator care or open crib care by using blanket in a warm room. This is also a limitation of this study because not all newborns used incubator care. But this study was done to compare early kangaroo care to LBW care which was performed in a real field setting situation.

We conclude that hypothermia events are less common in LBW newborns who are treated by EKC than by CC. There is no difference on the duration of birth weight regain in LBW newborns who are treated by EKC or CC. Percentage of birth weight decrease, frequency of breast feeding-perday, and hyperbilirubinemia events that need phototheraphy have a relationship with duration of birth weight regain. But, this finding must be confirmed by following studies.

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