Paediatrica Indonesiana

VOLUME 42 November - December • 2002 NUMBER 11-12

Original Article

Early kangaroo mother care vs. conventional method in stabilizing low birth weight infant: physiologic parameters (preliminary report)

Rulina Suradi, MD; Piprim B Yanuarso, MD;
Sudigdo Sastroasmoro, MD, PhD; Nani Dharmasetiawani, MD

ABSTRACT

Background Kangaroo mother care (KMC) has been accepted as an effective method in nursing low birth weight infant (LBWI). However, the application of this method in the early life of infants has not been studied in Indonesia. The aim of the study was to evaluate some physiologic parameters of LBWI treated with early KMC compared to conventional method.

Methods This was a randomized clinical-trial, which compared early KMC to conventional method in stabilizing LBWI in the first 4 hours of life. All LBWI (birth weight 1500-2499 g) born at Cipto Mangunkusumo Hospital and Budi Kemuliaan Maternity Hospital Jakarta were recruited consecutively in the period of November 2001 until March 2002. The inclusion criteria were spontaneous delivery, APGAR scores 1st and 5th minute ³7, and parental consent.

Results Sixty-four subjects distributed evenly into early KMC group and control group. One subject in the KMC group and three subjects in the control group were excluded due to respiratory distress. The mean birth weight was 2091 (SD 299.4) g in the KMC group and 2184 (SD 214.9) g in the control group. The mean gestational-age in both groups was 35.6 (SD 3.0) weeks. There were no statistical differences in mean temperature (p=0.281), heart rate (p=0.956), and respiratory rate (p=0.898) between the two groups during the first 4 hours of life. We found a larger proportion of infants reaching the temperature of 36.5ºC in the KMC group, especially at one hour (49% vs. 7%); the difference of proportion was 0.42 (95% CI 0.22;0.61).

Conclusion Early KMC method is proved to be as safe as conventional method in stabilizing healthy LBWI **[Paediatr Indones 2002;42:273-279].**

Keywords: *Low birth weight infant, kangaroo mother care method, and stabilization of LBWI.*

Various studies reported that maternal body heat is an efficient heat source to prevent hypothermia in a newborn baby, either normal[1] or low birth weight infant (LBWI).[2-4] This can happen if a mother contacts directly with her baby in the so-called "skin-to-skin contact"[2-5] or Kangaroo mother care (KMC) method.[6-8] Since introduced by Rey and Martinez, neonatologists from Bogota Columbia in 1978,[6] KMC had been well studied and accepted as an effective method in nursing LBWI, especially when incubators are not available.[7-18] This method gives many advantages for the baby and also the mother[17-20] i.e., bonding effect,[21,22] which could not be given by an incubator.

However, the application of this method in the early life of infants has not been well studied in Indonesia. Many studies reported the implementation of this method to LBWI who had been stabilized.[13,23,24] The aim of this study was to evaluate the role of early KMC method in stabilizing LBWI

From the Departments of Child Health, Medical School, University of Indonesia, Jakarta (RS, PBY, SS); Budi Kemuliaan Maternity Hospital, Jakarta (ND)

Reprint requests to: Rulina Suradi, MD, Department of Child Health, Medical School, University of Indonesia, Cipto Mangunkusumo, Jakarta, Indonesia. Tel. 62-21-3907740-42; Fax.: 62-21-3907743

in the first four hours of life compared to the conventional method. We assessed some physiologic parameters i.e., body temperature, heart rate, and respiratory rate of LBWI.

Methods

This was a preliminary report of a randomized clinical trial conducted at Cipto Mangunkusumo Hospital and Budi Kemuliaan Maternity Hospital Jakarta from 1 November 2001 until 31 March 2002. The source population was all LBWI (birth weight 1500-2499 g) who were born at Cipto Mangunkusumo Hospital from 1 November 2001 until 31 January 2002 and at Budi Kemuliaan Maternity Hospital from 1 February until 31 March 2002. The subjects were chosen consecutively. Immediately after resuscitation (10-30 minutes), subjects who met the criteria were divided randomly into 2 groups: early KMC and control. Sample size needed was 31 subjects for each group.

The inclusion criteria were spontaneous delivery, first and fifth minute Apgar scores $^{3}7$, the mother is healthy and stable after delivery, and a signed parental consent. Exclusion criteria were refusal to participate, severe congenital anomaly, and signs of neonatal emergencies such as chest retraction, grunting, tachypnea, central cyanosis, bradycardia, and hypothermia.

In the KMC group, the baby was placed between the mother's breasts and held in position by the mother's clothes. The baby wore a hat and a diaper. The mother lied on the bed in a supine or half-sitting position during this study. In the control group the baby wore no clothes, and immediately put into an already warmed up incubator. We measured the baby's temperature (axilla) in both groups, the mother's temperature (axilla) in the KMC group, incubator's temperature (control group), heart rate and respiratory rate of the baby in both groups at the beginning of the study, at minute 30th, 60th, 120th, 180th, and 240th. The body temperature was taken by using a mercury thermometer for at least 5 minutes. The heart rate and respiratory rate were counted manually for one minute using a stethoscope and a stopwatch and was taken three times. Four experienced nurses did the examination in three shifts of duty. The nurses were trained especially for the examination. If during this study the baby showed signs of neonatal emergencies, the subject was dropped out, resuscitated, and treated with usual procedures.

Table 1. Characteristics of subjects

No	Characteristic	Kangaroo method N=31	Incubator N=29
1	Sex:		
	Male	14 (45%)	17 (59%)
	Female	17 (55%)	12 (41%)
2	Mean birth weight	2091 g (SD 299.4) g	2184 g (SD 214.9) g
3	Mean gestational age	35.6 wks (SD 3.0) wks	35.6 wks (SD 3.0) wks
4	Maturity		
	Preterm infant (< 37 wks)	17 (55%)	16 (55%)
	Term infant (^{3} 37 wks)	14 (45%)	13 (45%)
5	Mean mother's age	26.0 yrs (SD 7.2) yrs	26.0 yrs (SD 7.2) yrs
6	Number of child		
	First child	18 (58%)	14 (48%)
	Second child	8 (26%)	8 (28%)
	Third child	2 (7%)	3 (10%)
	$\geq 4^{th}$ child	3 (9%)	4 (14%)
7	Education of the mother		
	Illiteracy	1 (3%)	0 (0%)
	Elementary school	11 (36%)	6 (20%)
	High school	16 (52%)	23 (80%)
	University	3 (9%)	0 (0%)

All data were recorded on a case report form and were analyzed using SPSS version 10.0. Descriptive data were presented in text, tables, and graphs. Analytical data were analyzed by chi-square and t-test. Degree of significance was <0.05.

Results

There were 64 subjects eligible for this study. They were divided at random into the early KMC group and the control group. One out of 32 subjects in the KMC group and 3 out of 32 subjects in the control group were dropped out due to respiratory distress. The mean birth weight was 2091 (SD 299.4) g in the KMC group and 2184 (SD 214.9) g in the control group. The mean gestational age in both groups was 35.6 (SD 3.0) weeks. Seventeen out of 31 subjects in the KMC group and 16 out of 29 subjects in the control group were preterm infants. **Table 1** shows characteristics of the 60 subjects who finished the study.

The comparison of mean temperature of LBWI in both groups is shown in F**igure 1**. From the beginning until the end of the study the mean temperature of LBWI in the KMC group was higher than the control group with no significant difference. At minute 240 the difference of mean temperature between the two groups was 0.3°C (95% CI –0.10;+0.32). The t test for independent-samples showed t=1.079, df =58, p=0.281.

In the KMC group, mean normal temperature of LBWI (36.5°C) was reached at minute 120th while in the control group at minute 180th. The difference of mean temperature of LBWI at the beginning and at the end of the study was same in both groups i.e., 1.4°C.

Figure 2 shows proportion of LBWI reaching normal temperature (36.5°C). The proportion was larger in the KMC group compared to the control group, especially at one hour (49% vs.7%, $x^2=12.703$; df=1; $p<0.001$); the difference of proportion was 0.42 (95% CI 0.22;0.61). At the end of this study, 29 out of 31 subjects in KMC group while in the control group 22 out of 29 subjects reached normal temperature (94% vs. 76%, $x^2=3.676$; df=1; p=0.055).

The relationship between temperature of the babies and the mother's temperature is shown in **Figure 3**. Before LBWI reached normal temperature, mother's temperature increased from 36.3 °C to 36.8°C in 120 minutes. After that, the increase was less high.

Figure 4 shows the comparison of mean heart rate of LBWI in both groups. From the beginning to the end of the study, we found no significant difference between mean heart rate of LBWI in both groups and they were within normal range (120-160 bpm). At minute 240, the difference of mean heart rate was 0.4 bpm (95% CI –2.9;+3.7). The t test for independent samples showed t=0.255 df=58 p=0.956.

The comparison of respiratory rate of LBWI in both groups is shown in **Figure 5.** We found no significant difference between mean respiratory rates of LBWI in both groups from the beginning to the

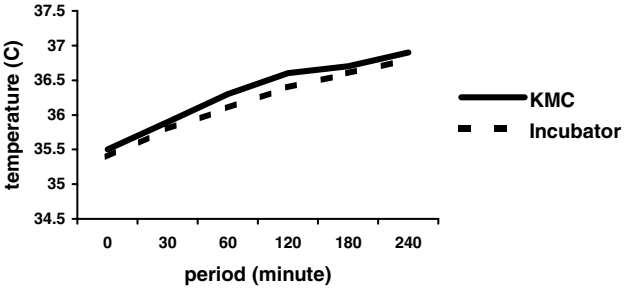

Figure 1. Mean temperature of LBWI in KMC group and incubator group

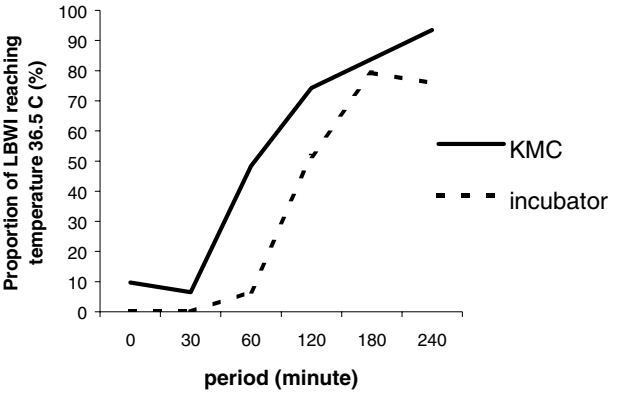

Figure 2. Proportion of LBWI reaching temperature 36.5°C in KMC group and incubator group

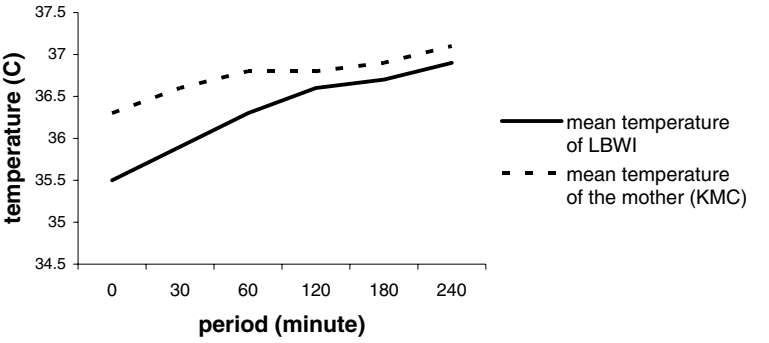

Figure 3. Mean temperature of LBWI and mean temperature of the mother in the KMC group

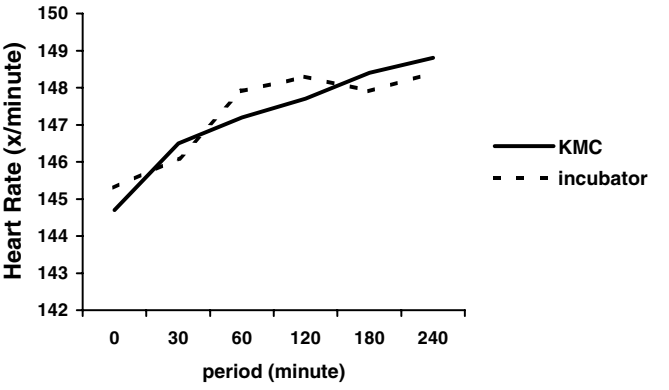

Figure 4. Mean heart rate of LBWI in KMC group and incubator group

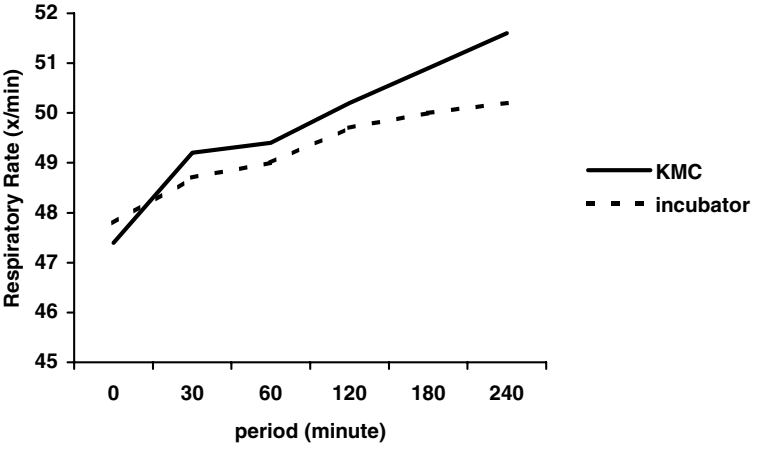

Figure 5. Mean respiratory rate of LBWI in KMC group and incubator group

end of the study and they were in normal range (40-60x/min). At minute 240 the difference of mean respiratory rate was 1.4 x/min (95% CI –1.7;+4.4). The t test for independent samples showed t=0.895, df=58, p=0.898.

Discussion

This was an open clinical trial so that blinding technique could not be done. Therefore measurement bias could possibly occur. To prevent this, we trained four nurses who had no interest with the aim of this study, to perform the measurement of the parameters. We also had no tool to make an objective measurement. To reduce the measurement bias, we did each measurement three times, except in taking the temperature.

The proportion of LBWI who were dropped out from this study was larger in the control group compared to the KMC group (3/32 vs. 1/32). All four subjects were dropped due to respiratory distress that might be caused by hypothermia, which occurred before the baby was stable. Another reason might be hypoglycemia that could cause cyanosis, tachypnea, or apnea.[5, 25] Unfortunately, we did not examine the blood glucose. After resuscitation with oxygenation and rewarming using a beam lamp, one subject from the KMC group and two subjects from the control group clinically improved. The remaining subjects from the control group suffered from respiratory distress syndrome due to suspected hyaline membrane disease. Since one subject suffered from respiratory distress during KMC method, we suggested closer observation of vital signs, especially if the infant had not been stable.

There were no statistical differences in the mean birth weight, mean gestational age, and mean mother's age between the groups, even though the mean birth weight of subjects in the KMC group were lower than that of the control group. The proportion of preterm infant was larger than full-term infant in both groups. In general, the characteristics of subjects in both groups were similar as a prerequisite of clinical trial (Table 1).

Our study found that the mean temperature of LBWI in the KMC group was 0.3°C higher than in the control group, even though the difference was not significant (95% CI –0.10; +0.32, p=0.281) (Figure 1). This was similar to the report from Bohnhorst, *et al* [26] who found that the mean rectal temperature of LBWI after nursed by KMC method was 0.4°C higher than that of babies nursed by incubator (p<0.01). Bauer *et al* [27,28] reported that the mean rectal temperature was 0.3°C higher (p<0.01) and the mean toe temperature was 0.6 °C higher (p<0.01) in LBWI nursed by KMC method compared to that by conventional method. Ludington-Hoe, *et al*[29] found that the mean toe temperature of LBWI after nursed by KMC method differed significantly from that by conventional method. Meanwhile, the mean abdominal temperature was not significantly different in both methods. The design of the three studies mentioned above was "before and after".

We found a larger proportion of infants reaching the temperature of 36.5ºC in the KMC group compared to the control group especially at one hour (49% vs. 7%). The difference of the proportion was 0.42 (95% CI 0.22; 0.61). After four hours 94% subjects in the KMC group and 76% subjects in the control group reached the temperature of 36.5°C (Figure 2). Our result was similar to that of Christensson K, *et al*[11] who reported a similar study in Lusaka, Zambia. They found that after four hours, the number of neonates reaching a temperature of 36.5°C was significantly higher in the KMC group than that of the control group (90% vs. 60%). Those results might be due to the absence of heat loss from evaporation, radiation, conduction, or convection in the KMC method. While in an incubator, heat loss from radiation could occur to more than 50%.[5]

Ludington-Hoe[8] reported the relationship between temperature of the mother and her baby during KMC. She found that when the baby is still 'cold', the mother's temperature would increase until the baby becomes 'warm' and then the mother's temperature would be constant or decrease. The mother was not aware of this phenomenon. Ludington Hoe named this phenomenon "maternal-neonatal thermal synchrony".[8] In our study (Figure 3), we found that during the first hour, before the babies reach normal temperature, the mother's temperature increased 0.5°C (36.3°C to 36.8°C). In the second hour, after the temperature of the babies reached 36.3°C, the mother's temperature became constant. In the third hour, after temperature

of the babies reached 36.5°C, the mother's temperature increased 0.1°C. We could not be sure whether our findings were the phenomenon mentioned above.

In our observation, the mean heart rate of both groups was not significantly different (Figure 4) and still in the normal range (120-160 bpm). This differed from Bohnhorst, *et al* [26] (design 'before and after') who found that in LBWI nursed by KMC, the mean heart rate was significantly higher than that of the subjects nursed by incubator, even though they were still in the normal range.

We also found that the mean respiratory rate of LBWI in both groups was not significantly different (Figure 5) and within the normal range (40-60 x/min). This also differed from Bohnhorst, *et al*[26] (design 'before and after') who reported that the mean respiratory rate of LBWI nursed by KMC was significantly higher than that of the controls. In addition, they found that non-regular breathing occurred more in the subjects nursed by KMC. They suggested that positional factors could play a role. During KMC the baby might have more neck flexion which could increase airway resistance.[26] On the contrary, Ludington-Hoe[30] noted that during KMC the baby's respiration became deeper, the occurrence of apnea was four times less frequent, episodes of apnea decreased, and periodic breathing was less frequent.

We concluded that early KMC method is proved to be as safe as conventional method in stabilizing healthy LBWI and is a very useful method especially when incubators are not available.

References

1. Christensson K, Siles C, Moreno L, Belaustequi A, De La Fuente P, Lagercrantz H, *et al*. Temperature, metabolic adaptation and crying in healthy full-term newborns cared for skin-to-skin or in a cot. Acta Paediatr 1992;81:488-93.
2. Mondlane RP, da Graca AMP, Ebrahim GJ. Skin-to-skin contact as a method of body warmth for infants of low birth weight. J Trop Pediatr 1989;35:321-6.
3. Acolet D, Sleath K, Whitelaw A. Oxygenation, heart rate and temperature in low birth weight infants during skin-to-skin contact with their mothers. Acta Paediatr Scand 1989;78:189-93.
4. Bauer K, Uhrig C, Sperling P, Pasel K, Wieland C, Versmold HT. Body temperatures and oxygen consumption during skin-to-skin (kangaroo) care in stable preterm infants weighing less than 1500 grams. J Pediatr 1997;130:240-4.
5. World Health Organization. Thermal control of the newborn: a practical guide. WHO/FHE/MSM/93.2
6. Whitelaw A, Sleath K. Myth of the marsupial mother: home care of very low birth weight babies in Bogota, Colombia. The Lancet 1985;I:1206–8.
7. Cattaneo A, Davanzo R, Uxa F, Tamburlini G. Recommendations for the implementation of kangaroo mother care for low birthweight infants. Acta Paediatr 1998;87:440–5.
8. Ludington-Hoe SM, Golant SK. Kangaroo care, the best you can do to help your preterm infant. New York: Bantam Books; 1993. p. 3-30.
9. Sloan NL, Camacho LWL, Rojas EP, Stern C. Kangaroo mother method: randomized controlled trial of an alternative method of care for stabilized low-birth weight infants. The Lancet 1994;344:782–5.
10. Bergman NJ, Jurisoo LA. The 'kangaroo-method' for treating low birth weight babies in a developing country. Tropical Doctor 1994;24:57-60.
11. Christensson K, Bhat GJ, Amadi BC, Eriksson B, Hojer B. Randomized study of skin-to-skin versus incubator care for rewarming low risk hypothermic neonates. The Lancet 1998;352:1115.
12. Charpak N, Ruiz-Pelaez JG, Figueroa de CZ, Charpak Y. Kangaroo mother versus traditional care for newborn infants £2000 grams: a randomized, controlled trial. Pediatrics 1997;100:683-8.
13. Cattaneo A, Davanzo R, Worku B, Surjono A, Echeverria M, Bedri A, *et al*. Kangaroo mother care for low birth weight infants: a randomized controlled trial in different settings. Acta Paediatr 1998;87:976-85.
14. Charpak N, Ruiz-Pelaez JG, Charpak Y. Rey-Martinez kangaroo mother program: an alternative way of caring for low birth weight infants? One-year mortality in a two-cohort study. Pediatrics 1994;94: 804-10.
15. Whitelaw A. Kangaroo baby care: just a nice experience or an important advance for preterm infants? Pediatrics 1990;85:604-5.
16. Charpak N, Ruiz-Peláez JG, Figueroa de CZ, Charpak Y. A randomized, controlled trial of kangaroo mother care: results of follow-up at 1 year of corrected age. Pediatrics 2001;108:1072-79.

17. Feldman R, Eidelman AI, Sirota L, Weller A. Comparison of skin-to-skin (kangaroo) and traditional care: parenting outcomes and preterm infant development. Pediatrics 2002;110:16-26.
18. Hurst NM, Valentine CJ, Renfro L, Burns P, Ferlic L. Skin-to-skin holding in the neonatal intensive care unit influences maternal milk volume. J Perinatol 1997;17:213-7.
19. Furman L, Minich N, Hack M. Correlates of lactation in mothers of very low birth weight infants. Pediatrics 2002;109:e57
20. Gray L. Skin-to-skin contact is analgesic in healthy newborns. *Pediatrics 2000;105:e14*
21. Tessier R, Cristo M, Velez S, Giron M, Figueroa de Calume Z, Ruiz-Pelaez JG, *et al*. Kangaroo mother care and the bonding hypothesis. Pediatrics 1998;102:1-8.
22. Anderson GC. Touch and the kangaroo care method. In: Field TM, editor. Touch in early development. New Jersey: Lawrence Erlbaum Associates; 1995. p. 35-51.
23. Alisjahbana A, Usman A, Irawaty S, Triyati A. Prevention of hypothermia of low birth infants using the kangaroo method. Paediatr Indones 1998;38:205-14
24. Suradi R, Chair I, Thaha RM. Acceptance of the kangaroo care method by mothers in the rural area. Paediatr Indones 1998;38:215-19.
25. Gomella TL. Hypoglycemia. In: Gomella, Cunningham MD, Eyal FG, Zenk KE, editors. Neonatology: management, procedures, on-call problems, diseases, and drugs. New York: Lange Medical Books, 1999. p 247-51.
26. Bohnhorst B, Heyne T, Peter CS, Poets CF. Skin-to-skin (kangaroo) care, respiratory control, and thermoregulation. J Pediatr 2001;138:193-7.
27. Bauer K, Uhrig C, Sperling P, Pasel K, Wieland C, Versmold H. Body temperatures and oxygen consumption during skin-to-skin (kangaroo) care in stable preterm infants weighing less than 1500 grams. J Pediatr 1997;130:240-4
28. Bauer K, Pyper A, Sperling P, Uhrig C, Versmold H. Effects of gestational and postnatal age on body temperature, oxygen consumption, and activity during early skin-to-skin contact between preterm infants of 25-30-week gestation and their mothers [abstract]. Pediatr Res 1998;44:247-51.
29. Ludington-Hoe SM Kangaroo care compared to incubators in maintaining body warmth in preterm infants [abstract]. *Biol Res Nurs* 2000;2:60-73.
30. Ludington-Hoe SM, Golant SK. Kangaroo care, the best you can do to help your preterm infant. New York: Bantam Books; 1993. p. 67-84.