

Newborn Temperature During Skin-to-Skin Breastfeeding in Couples Having Breastfeeding Difficulties

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ABSTRACT: Background: Kangaroo (skin-to-skin contact) care facilitates the maintenance of safe temperatures in newborn infants. Concern persists that infants will become cold while breastfeeding, however, especially if in skin-to-skin contact with the mother. This concern might be especially realistic for infants experiencing breastfeeding difficulties. The objective was to measure temperature during a study of mothers and infants who were having breastfeeding difficulties during early postpartum and were given opportunities to experience skin-to-skin contact during breastfeeding. **Method:** Forty-eight full-term infants were investigated using a pretest-test-posttest study design. Temporal artery temperature was measured before, after, and once during 3 consecutive skin-to-skin breastfeeding interventions and 1 intervention 24 hours after the first intervention. **Results:** During skin-to-skin contact, most infants reached and maintained temperatures between 36.5 and 37.6 °C, the thermoneutral range, with only rare exceptions. **Conclusions:** The temperatures of study infants reached and remained at the thermoneutral range during breastfeeding in skin-to-skin contact. The data suggest that mothers may have the ability to modulate their infant's temperature during skin-to-skin contact if given the opportunity. Hospital staff and parents can be reassured that, with respect to their temperature, healthy newborn infants, with or without breastfeeding difficulties, may safely breastfeed in skin-to-skin contact with their mothers. (*BIRTH* 32:2 June 2005)

Thermoregulation is one of the major tasks of extra-uterine adaptation for all newborn infants. If body temperature is maintained within a normal range, caloric expenditure and oxygen consumption are

minimal. If excessive effort is needed to produce heat when cold stress persists, newborn infants may experience adverse metabolic events such as hypoxemia, acidosis, and hypoglycemia (1).

Since its inception in 1979, kangaroo (ventral skin-to-skin contact) care has been documented to facilitate safe temperatures in newborn infants during the first few minutes or hours after birth. Fardig (2) and Vaughans (3) reported that temperatures of full-term infants during skin-to-skin contact compared with those under radiant warmers. Christensson et al (4,5) found that the temperatures of healthy full-term infants experiencing skin-to-skin contact, even without feeding, were significantly higher than temperatures in infants placed in a bassinet next to their mother's bed. Karlsson's findings are similar in that the 9 newborn infants studied attained and maintained rectal temperatures at an average of 37 °C during 60 minutes of skin-to-skin contact (6). Bystrova

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et al documented similar findings (7). Even preterm infants attained and maintained their body warmth during skin-to-skin contact when compared with those cared for in incubators (8,9).

To date, however, temperature has not been reported in studies of skin-to-skin contact with a focus on the breastfeeding process. Durand et al, in the study most similar to ours, examined temperatures in two groups of mother and full-term infant couples (10). One group chose to breastfeed and the other group chose to formula feed during a 2-hour period beginning within 30 minutes after birth. During these 2 hours, breastfed infants experienced skin-to-skin contact and formula-fed infants were cared for and fed under radiant warmers (10). Regardless of temperature at study entry, all breastfed infants had reached a safe range of temperature after skin-to-skin contact (36.5 to 37.8 °C; 97.7 to 100 °F). However, important differences exist between this study and our study. In the Durand et al study, skin-to-skin contact began sooner and was given only once, and temperatures were taken only at the beginning and end of skin-to-skin contact but not during the contact.

Despite these outcomes and evidence from a Cochrane meta-analysis (11), hospital staff continue to express concern that infants will become cold during skin-to-skin contact (12). Concern that hypothermia might occur during breastfeeding could be legitimate for several reasons, especially if breastfeeding was not going well. As the mother focuses on achieving a successful breastfeeding, she frequently changes her infant's position and her breastfeeding techniques change accordingly. Meanwhile, the infant may seem confused and frustrated and may begin to cry and resist. During this process, the infant may become partially uncovered and the mother may not notice. For this reason, and to be prudent, we decided to measure temperature in a study in which the objective was to see whether skin-to-skin contact would be a useful intervention for mothers and newborn infants having breastfeeding difficulties. Infant temporal artery temperature was taken before, once during, and at the end of each skin-to-skin contact during breastfeeding to document temperature changes specifically in this population for this intervention.

The Anderson Mutual Caregiving Model, first reported in 1977, was used to guide this study. In proposing this model, Anderson stated that "the maternal milieu offers the ideal micro-environment wherein a mix of salient stimuli can be made available to the newborn in optimal fashion" (13, p 52), and later stated that "the maternal milieu is the ambience that the mother creates when she holds her newborn

infant closely, especially skin-to-skin, and provides self-regulatory breastfeeding" (14, p 605).

Methods

The study was approved by the Institutional Review Board at the study site and was conducted on the postpartum unit of University MacDonald Women's Hospital, University Hospitals of Cleveland, Ohio, a large teaching and research hospital licensed as a Level III perinatal center. Fifty mother-infant couples were enrolled between February and October 2002. Mothers were at least 18 years of age, and their full-term singleton infants were sufficiently healthy to experience skin-to-skin contact and were having breastfeeding difficulties identified between 12 and 24 hours after birth. A one-group pretest-test-posttest design was used to measure temperature.

The study procedure was as follows: every weekday morning, with assistance from staff nurses on the unit, the nurse researcher identified mother-infant couples who met the inclusion criteria. When a mother-newborn infant couple with breastfeeding difficulties was identified, the researcher approached the mother to explain the study and to obtain informed consent. After informed consent was given, the researcher then asked the mother to describe her last breastfeeding experience and entered this information on the Mother-Baby Assessment form (15), which is a measure of attachment to the breast and suckling. A score of 10 indicated successful latch and breastfeeding; a score of less than 8 indicated breastfeeding difficulties and maintained the couple's eligibility for study participation.

The researcher helped couples experience skin-to-skin contact during 4 breastfeeding sessions. The first 3 interventions were done consecutively on the first day, and the fourth intervention was done the next day as close as possible to 24 hours after the first intervention. Each intervention followed a protocol whereby infants were placed in skin-to-skin contact on the mother's chest 30 minutes before the next anticipated feeding. Temperature readings were taken just before skin-to-skin contact, 30 minutes into skin-to-skin contact, and just before the end of skin-to-skin contact.

A temporal scanner (TAT-5000 from Exergen Corporation, Watertown, Massachusetts, USA) was used to measure temperature. Temperatures taken with the temporal thermometer are highly correlated with esophageal and rectal temperatures (16,17). Temporal artery temperature (36.3 to 37.8 °C) is slightly lower than rectal temperature (36.5 to

37.9 °C) (18). The researchers were shown how to use the thermometer and, because of its simplicity, interrater reliability was easily achieved. Complete information on other dependent measures in this study and the 1-week and 1-month follow-up protocols can be found in Anderson et al (19).

Results

Data were analyzed using percent, mean, standard deviation, and range. Of the 50 recruited mother-infant couples, couple 4 withdrew from the study after the infant's father became upset because the couple was experiencing so many interruptions, and couple 5 was withdrawn because the infant had an anatomical defect (nasal constriction) that the pediatrician believed would prevent breastfeeding. The 48 remaining infants (24 girls and 24 boys) were born at between 37 and 40 weeks' gestation ($M = 39$, $SD = \pm 0.95$) and weighed 2,490 to 4,415 g ($M = 3396$, $SD = \pm 455$). Mean postnatal age at enrollment was 16.52 hours ($SD = \pm 4.18$). Thirty-five infants were born vaginally. Twenty-five mothers were Caucasian, 16 African American, 6 Asian/Pacific Islander, and one Puerto Rican. Thirty-two (67%) mothers were married and 35

(73%) were primiparas. Before beginning intervention one, the mean score for maternal self-report on the Mother-Baby Assessment was 2.6 ($SD = \pm 2.2$, range: 0–7).

Temperature data on all three data points was obtained for each of the four skin-to-skin breastfeeding interventions for 39, 36, 12, and 22 infants, respectively. Table 1 presents temperatures at three data points in each intervention and temperatures of infants who were breastfeeding and not breastfeeding at 30 minutes into skin-to-skin contact. No breastfeeding occurred in 5 infants during the first intervention and 4 infants during the second intervention. During skin-to-skin contact, most infants had temperatures between 36.5 and 37.6 °C, the thermoneutral range (20). Thermoneutral range is the range of body temperature within which energy expenditure is at a minimum (1).

However, a few exceptions were seen. For one infant, the 3 temperature measurements during the first intervention were 36.2, 36.4, and 36.4 °C. Two other infants had high initial temperatures that showed a decreasing pattern of 37.5, 37.2, 36.8 °C and 37.4, 37.2, 37.2 °C. Another infant with an initial temperature of 37.3 °C maintained a temperature at 37.4 °C during 45 minutes of skin-to-skin contact. Similar exceptions were seen during interventions

Table 1. Infant Temperatures During Breastfeeding with Skin-to-Skin Contact (SSC)

<i>Infant Temperature for Each Skin-to-Skin Breastfeeding</i>				
<i>Time</i>	<i>No.</i>	<i>Pre SSC</i>	<i>30 Min Later</i>	<i>End of SSC</i>
SB1 ^a	39 ^b	36.7 ± 0.3 (36.2–37.5)	36.8 ± 0.2 (36.4–37.4)	36.8 ± 0.2 (36.4–37.4)
SB2	36 ^c	36.8 ± 0.3 (36.2–37.5)	36.8 ± 0.2 (36.3–37.3)	36.9 ± 0.2 (36.3–37.4)
SB3 ^d	12	36.7 ± 0.2 (36.3–37.0)	36.8 ± 0.2 (36.4–37.0)	36.8 ± 0.2 (36.4–37.2)
SB4 ^e	22	36.6 ± 0.2 (36.2–37.0)	36.7 ± 0.2 (36.4–37.0)	36.8 ± 0.1 (36.4–37.0)
<i>Infants Who Were Breastfeeding 30 Minutes After Skin-to-Skin Contact Began</i>				
<i>Time</i>	<i>No.</i>	<i>Pre SSC</i>	<i>30 Min Later</i>	<i>End of SSC</i>
SB1	17	36.6 ± 0.3 (36.2–37.3)	36.8 ± 0.2 (36.3–37.4)	36.8 ± 0.2 (36.4–37.4)
SB2	15	36.8 ± 0.3 (36.4–37.4)	36.9 ± 0.2 (36.5–37.2)	36.9 ± 0.2 (36.6–37.4)
SB3	8	36.7 ± 0.1 (36.6–36.9)	36.7 ± 0.2 (36.4–37.0)	36.8 ± 0.2 (36.4–37.2)
SB4	16	36.6 ± 0.2 (36.2–37.0)	36.7 ± 0.2 (36.4–37.0)	36.8 ± 0.2 (36.4–37.0)
<i>Infants Who Were Not Breastfeeding 30 Minutes After Skin-to-Skin Contact Began</i>				
<i>Time</i>	<i>No.</i>	<i>Pre SSC</i>	<i>30 Min Later</i>	<i>End of SSC</i>
SB1	17	36.7 ± 0.4 (36.2–37.5)	36.9 ± 0.3 (36.4–37.2)	36.9 ± 0.2 (36.5–37.3)
SB2	17	36.6 ± 0.3 (36.2–37.2)	36.8 ± 0.2 (36.3–37.2)	36.9 ± 0.2 (36.3–37.2)
SB3	4	36.7 ± 0.3 (36.3–37.0)	36.8 ± 0.1 (36.6–36.9)	36.9 ± 0.1 (36.8–37.0)
SB4	6	36.6 ± 0.1 (36.5–36.7)	36.8 ± 0.1 (36.7–37.0)	36.8 ± 0.1 (36.7–37.0)

Note: All values represent mean, standard deviation (\pm), and range.

^aSB = skin-to-skin breastfeeding; ^bfive infants did not breastfeed; ^cfour infants did not breastfeed; ^dresearch staff were not available because of delayed feeding times; ^esome mothers chose to delay or had not yet begun this feeding.

two, three, and four. An interesting, but puzzling, exception was observed during intervention two, when the infant's temperature remained at 36.3°C with 50 minutes of skin-to-skin contact. The infant had a slightly stuffy nose, but was able to breastfeed successfully. Later, during intervention four, the same infant's temperature increased from 36.4 to 36.8°C after 30 minutes of skin-to-skin contact.

Further analyses were done to examine the temperature data on 32 infants who had complete data during interventions one and two. Four infants did not breastfeed at either intervention. Demographics of these infants and their mothers are presented in Table 2. Temperatures of these 32 infants and their temperature data were then divided into two subgroups based on whether they were breastfeeding at 30 minutes into skin-to-skin contact (Table 3).

Discussion

The temperature data reported here differ in several ways from those in other studies, irrespective of whether or not breastfeeding was the focus (2–10). The mother-infant couples in this sample were experiencing breastfeeding difficulties between 12 and 24 hours after birth, they received a skin-to-skin contact intervention during four breastfeeding sessions, and the temperature data were collected before, during, and at the end of each of these sessions.

Most infant temperatures reached and remained within the clinically accepted thermoneutral range (36.5 to 37.6°C) for healthy full-term newborn infants. Whether or not these temperatures occurred by way of maternal or infant mechanisms or both is unknown. Nevertheless, the fact that appropriate temperatures occurred in infants with breastfeeding

Table 2. Maternal and Infant Demographics (*n* = 32)

<i>Variable</i>	<i>Mean</i>	<i>SD (±)</i>	<i>Range</i>
Age (yr)	28.8	6.2	18–41
Education (yr)	14.8	2.3	10–18
Gestation (wk)	39.1	0.9	38–41
Birthweight (g)	3,363	445	2,490–4,390
Discharge weight (g)	3,162	401	2,365–4,050

	<i>No.</i>	<i>(%)</i>
Maternal race		
African American	10	(31.3)
White	16	(50.0)
Asian/Pacific Islander/Puerto Rican	6	(18.7)
Marital status		
Married	20	(62.5)
Single	12	(37.5)
Employment status		
Full time	20	(62.5)
Part time	5	(15.6)
Unemployed	4	(12.5)
Student	3	(9.4)
Delivery method		
Vaginal	21	(65.6)
Cesarean section	8	(25.0)
Vacuum/forceps	3	(9.4)
Analgesia/anesthesia		
None	3	(9.4)
Epidural	20	(62.5)
Pain medication and epidural	9	(28.1)
Deep suction at birth		
Yes	13	(40.6)
No	19	(59.4)
Parity		
Primipara	25	(78.1)
Multipara	7	(21.9)
Infant gender		
Male	14	(43.7)
Female	18	(56.3)

difficulties is reassuring because these mothers were positioning their infants many different ways in an effort to breastfeed successfully.

This study extends previous work on infant temperature during skin-to-skin contact (4–6), as well as evidence from a recent Cochrane review (11). Most recently, Bystrova et al randomly assigned 176 newborn infants to three primary treatment groups (skin-to-skin contact, $n = 44$; mother's arms, $n = 44$; nursery, $n = 88$) 30 minutes after birth (7). Axillary, intrascapular, thigh, and foot temperatures of skin-to-skin contact infants with 90 minutes of skin-to-skin contact in the delivery room had significantly higher temperatures than infants who stayed in the nursery. The largest temperature increase was seen in peripheral sites (such as thigh and foot) in the skin-to-skin contact group compared with the nursery group.

Interestingly, during the skin-to-skin contact intervention, infant temperature not only increased to the thermoneutral range when infants were cool, but also decreased if infants were too warm. For example, during the first intervention, 2 infants had temperatures of 36.2 °C before skin-to-skin contact, and their temperatures increased to 36.4 and 36.6 °C at 30 minutes and stayed at this level during the entire skin-to-skin contact. In contrast, temperatures of 2 other infants decreased from 37.5 to 36.8 °C and from 37.4 to 37.2 °C during skin-to-skin contact. These data suggest that mothers may have the ability to modulate their infant's temperature during skin-to-skin contact, if given the opportunity.

Although our sample was ethnically diverse, surprisingly little variation was seen on other demographic or clinical variables, such as infant birthweight, gestational age, maternal age, parity, and delivery mode. Our study had some limitations that should be noted. First, most of the infants were appropriate for gestational age. Most mothers were 28 years old on average, married, and had delivered vaginally, and hence, it may not be possible to generalize our results to other populations. Second, although interventions three and four were called for in the protocol, these could not always be done. Occasionally intervention three was omitted when enrollment did not occur until late morning or when frequent interruptions led to prolonged inter-feeding intervals (19). In these cases the third intervention would not have occurred until early evening, when research staff were no longer available. Intervention four was also sometimes omitted if it occurred shortly before discharge because most mothers were involved in the discharge process and eager to go home. For this reason they sometimes chose to begin breastfeeding before the researcher arrived or to postpone this breastfeeding until they arrived home. However, we found no systematic error in these missing data, and also determined that couples completing versus not completing interventions three and four did not differ in demographic and clinical variables that might have affected the temperature results. Third, surprisingly, no randomized controlled trials have been done to date to measure temperature when healthy full-term newborn infants are breastfeeding in skin-to-skin contact.

Table 3. Infant Temperatures During Breastfeeding with Skin-to-Skin Contact (SSC) with Complete Data on SB1 and SB2

<i>Infant Temperature for Skin-to-Skin Breastfeedings 1 and 2</i>				
<i>Time</i>	<i>No.</i>	<i>Pre SSC</i>	<i>30 Min Later</i>	<i>End of SSC</i>
SB1 ^a	32 ^b	36.7 ± 0.4 (36.2–37.5)	36.8 ± 0.2 (36.4–37.4)	36.8 ± 0.2 (36.4–37.4)
SB2	32 ^c	36.8 ± 0.3 (36.2–37.5)	36.9 ± 0.2 (36.5–37.3)	36.9 ± 0.2 (36.4–37.4)
<i>Infants Who Were Breastfeeding 30 Minutes After Skin-to-Skin Contact Began</i>				
<i>Time</i>	<i>No.</i>	<i>Pre SSC</i>	<i>30 Min Later</i>	<i>End of SSC</i>
SB1	14	36.6 ± 0.3 (36.2–37.3)	36.8 ± 0.2 (36.4–37.4)	36.9 ± 0.3 (36.4–37.4)
SB2	12	36.8 ± 0.3 (36.4–37.4)	36.8 ± 0.2 (36.5–37.2)	36.9 ± 0.2 (36.6–37.4)
<i>Infants Who Were Not Breastfeeding 30 Minutes After Skin-to-Skin Contact Began</i>				
<i>Time</i>	<i>No.</i>	<i>Pre SSC</i>	<i>30 Min Later</i>	<i>End of SSC</i>
SB1	14	36.8 ± 0.4 (36.2–37.5)	36.9 ± 0.3 (36.4–37.2)	36.9 ± 0.2 (36.5–37.2)
SB2	16	36.7 ± 0.3 (36.2–37.2)	36.8 ± 0.2 (36.6–37.2)	36.9 ± 0.2 (36.4–37.2)

Note: All values represent mean, standard deviation (±), and range.

^aSB = skin-to-skin breastfeeding; ^bfour infants did not breastfeed; ^cfour infants did not breastfeed.

Even though participants in this study served as their own controls, physical maturation that occurs very rapidly after birth may affect temperature.

In other words, both the mothers and their infants were continuing to recover from the stress of birth and adapting physiologically to their postpartum and extrauterine condition. This phenomenon could only be fully controlled with a randomized controlled trial in which any effect of maturation on temperature can be separated from the effect of skin-to-skin contact.

Furthermore, several recommendations for future studies can be suggested from our experience. First, additional research staff are needed to cover evening shifts. Second, for studies with a similar design, researchers should recruit mother-infant couples with breastfeeding difficulties no later than 12 hours postpartum to avoid having the fourth intervention occur around discharge time. Third, to provide more definitive data during each feeding, more temperature measurements are needed; these can be done with minimal disturbance using the temporal artery thermometer. Fourth, as simple as it sounds, training sessions on skin-to-skin contact may need to be provided for hospital staff. It is possible that with incorrect skin-to-skin position, infant temperature may decrease.

Clinical Guidelines

These temperature results provide solid evidence that when mother-infant couples breastfeed skin-to-skin using a safe technique, concern for hypothermia is unfounded. Guidelines for safe skin-to-skin breastfeeding include the following: The infant should wear a diaper small enough to maximize the ventral area available for skin-to-skin contact, and the mother should wear clothing that can be opened down the front. The typical hospital breastfeeding gown has a small opening in the front that, although well intended, makes chest-to-chest skin contact impossible; this problem can be solved by wearing these gowns backwards. If skin-to-skin contact occurs soon after birth, all infants should wear a cap at first and the cap should be replaced as soon as it becomes damp. If the ambient temperature is cool, a blanket can be placed *across* the infant's back, *never between* the infant and mother. If needed, additional warmth can be provided with a warm bath blanket folded in half, placed across the infant's back, and tucked under the mother. Hospital staff need to remind the mother to maintain these safe practices throughout each skin-to-skin breastfeeding.

Conclusions

The temperatures of the infants in our study reached thermoneutral range and remained there during breastfeeding in skin-to-skin contact. Since these mothers and their infants were experiencing breastfeeding difficulties, one can reasonably assume that it would be even easier to provide adequate warmth for full-term infants who are breastfeeding successfully. Hospital staff and parents can be reassured that, with respect to their temperature, healthy newborn infants, with or without breastfeeding difficulties, may safely breastfeed in skin-to-skin contact with their mothers.

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