



Full length article

## An experimental study on mother-infant skin-to-skin contact in full-terms



Rosieriet Beijers\*, Linda Cillessen, Maartje A.C. Zijlmans

Department of Developmental Psychology, Behavioral Science Institute, Radboud University Nijmegen, The Netherlands

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### ABSTRACT

In premature infants, daily skin-to-skin contact (SSC) has various beneficial effects on the health of the infant and the mother. These beneficial effects might extend to full-term infants. This experimental within-subject study examines the immediate effects of SSC on full-terms' cortisol physiology during SSC and subsequent physiological and behavioral reactions to a mild stressor (a bathing session). Additionally, the effects of SSC on the quality of maternal behavior are examined.

Between 5 and 7 weeks postpartum, 17 full-term infant-mother dyads were visited at home twice. During one home visit, a bathing session was preceded by 50 min of mother-infant SSC, while during the other visit the bathing session was preceded by 50 min of the infant resting alone. The order of the home visits was counterbalanced. Infant salivary cortisol measures were taken to measure the cortisol response to the experimental condition (SSC versus solitary resting) and the bathing session. Furthermore, infant behavioral distress and the quality of maternal behavior during the bathing session were scored from videotapes.

Two-way within-subject repeated measures ANOVA's showed that, when compared to solitary resting, full-terms' cortisol concentrations significantly decreased during SSC, followed by higher cortisol reactivity in response to the subsequent bathing session. No effects of SSC on infant behavioral distress and maternal caregiving behavior were found. Apparently, a single session of mother-infant SSC can affect infant cortisol physiology in full-term infants. Future SSC research is needed to investigate the neurobiological mechanisms and dose-response relations in full-term infants.

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## 1. Introduction

Research in premature infants shows that skin-to-skin contact (SSC or Kangaroo Care) facilitates infant and maternal outcomes. During SSC, the naked infant is placed belly-down in a stable position on the mother's chest. In premature infants, SSC is, for example, related to increased weight gain, fewer infections and less crying, as well as higher quality of maternal caregiving behavior (Conde-Agudelo & Diaz-Rossello, 2014; Moore, Anderson, Bergman, & Dowswell, 2012; Feldman, Eidelman, Sirota, & Weller, 2002; Feldman, Weller, Sirota, & Eidelman, 2003). Potentially, SSC also has positive effects in full-term infants and their mothers, although much less research is conducted in this group. This experimental

\* Corresponding author at: Rosieriet Beijers, Developmental Psychology, Behavioral Science Institute, Radboud University, P.O. Box 9140, 6500HE Nijmegen, The Netherlands.

E-mail address: r.beijers@psych.ru.nl (R. Beijers).

**Table 1**  
Descriptive statistics of the sample.

	Mean (SD)	Range
Maternal age (years)	29.3 (3.2)	24–36
Maternal educational level (%)		
Primary education	6%	
Secondary education	23%	
College or university	71%	
Maternal employment (%)	88%	
Infant sex (%)		
Male	41%	
Birth weight (grams)	3382 (419)	2765–4250
Apgar score at 5 min	9.7 (.6)	8–10
Exclusive breastfeeding (%)	73.3%	

within-subject study examines the acute effects of SSC on full-terms' physiological responses to SSC, subsequent behavioral and physiological responses to a mild stressor, and the quality of maternal behavior.

The few studies that have been conducted in term neonates show that the beneficial effects of SSC in pre-terms are likely to extend to full-terms (Moore, Anderson, & Bergman, 2007). For example, when SSC was performed shortly after birth, term neonates subsequently slept longer and were mostly in a quiet sleep state (Ferber & Makhoul, 2004). To date, the underlying neurobiological mechanisms are not yet understood. One hypothesis is that the intimate contact between mother and infant fulfills basic biological needs of the infant (such as warmth, touch, and smell) and thereby regulates infant physiology, including the Hypothalamic–Pituitary–Adrenal-axis (HPA-axis; Feldman, Rosenthal, & Eidelman, 2014; Moore et al., 2012). When confronted with stressors, the HPA-axis is activated and the end product cortisol is produced (Jansen, Beijers, Riksen-Walraven, & de Weerth, 2010b). While this response helps to deal with a stressor, frequent and chronic stress responses can take a toll on the body and are related to physical and mental health problems (Herman, 2013; Lupien, McEwen, Gunnar, & Heim, 2009). SSC might help the infant to regulate cortisol physiology, and indeed, a 20-min period of mother–infant SSC was related to a significant reduction in cortisol concentrations in pre-terms (Gitau et al., 2002).

Furthermore, studies in term neonates found that SSC prior to an injection stressor decreased infant behavioral stress responses including crying (Castral, Warnock, dos Santos, Dare, Moreira, Antonini, & Scochi, 2015; Gray, Watt, & Blass, 2000; Kashaninia, Sajedi, Rahgozar, & Noghabi, 2008). These results suggest that SSC might be a promising intervention to reduce infant distress during stressful pain procedures and is in line with research showing that support before a stressor can decrease stress reactions (Kirschbaum, Klauer, Filipp, & Hellhammer, 1995).

Besides the infant, it is also suggested that SSC positively affects the mother (Roller, 2005). For example, SSC is related to more sensitivity and less intrusiveness in mothers from pre-terms (Feldman et al., 2002, 2003), and reduced postpartum depressive symptoms and cortisol concentrations in mothers from full-terms (Bigelow, Power, MacLellan-Peters, Alex, & McDonald, 2012).

The present experimental within-subject study focuses on full-terms of around 6 weeks of age, in contrast to most prior studies focusing on SSC directly after birth. We will examine how a period of 50-min of mother–infant SSC, compared to a condition of the infant resting alone, influences infant cortisol physiology and behavior, and the quality of maternal caregiving behavior. We hypothesized that SSC reduces infant cortisol concentrations during SSC and reduces infant stress responses to the bath (lower cortisol reactivity and less behavioral distress). Lastly, we hypothesized that SSC increases the quality of maternal caregiving behavior (sensitivity and cooperation).

## 2. Methods

### 2.1. Participants

Participants were recruited via midwifery practices, social media and online news letters. This project was approved by the Institutional Ethical Committee, which follows the Helsinki Declaration. Only healthy infants ( $\geq 2500$  g birth weight,  $\geq 7$  Apgar scores at 5 min) born full-term ( $\geq 37$  weeks of pregnancy) were included. The sample consisted of 17 mother–infant dyads. All mothers gave written informed consent for participation. Demographics of the infants and mothers can be found in Table 1. None of the mothers practiced SSC with their infant during the first postnatal weeks.

### 2.2. Procedure

Between 5 and 7 weeks postpartum, the infants and their mothers were visited at home twice. During one of the home visits, a bathing session was preceded by 50 min of SSC contact between mother and infant. During the other visit, the bathing session was preceded by 50 min of the infant resting alone. The order of the home visits was counterbalanced and both visits were scheduled at the same time of the day to facilitate comparisons between the two visits.

The two home visits had the same structure. After arrival, the test leader shortly explained the procedure of the visit, asked some general questions about the condition of the infant and took the first infant saliva sample which acted as the

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