



# The impact of maternal stress on initiation and establishment of breastfeeding

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## KEYWORDS

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Cortisol;  
Lactation parameters;  
Establishment;  
Milk volume

**Abstract Objective:** The aim of this study was to explore the impact of maternal stress on initiation, and establishment of breastfeeding.

**Methods:** Ninety five women were included in the study. Maternal stress was assessed: (1) objectively, with plasma cortisol levels taken from participants' as well as the umbilical cord blood, 10 min after delivery; (2) subjectively, with self-reported questionnaires administered 1 h and 4 days after delivery. Detailed records of breastfeeding parameters were obtained.

**Results:** Multivariate analyses indicated that controlling for age, and use of epidural during labor, post-delivery stress score was significantly associated with delayed initiation of lactation, lower milk volume, less frequent feedings and shorter duration of first feeding. Mothers' positive emotions were positively associated with feed frequency. Cortisol levels were not significantly related to initiation and establishment of breastfeeding.

**Conclusion:** Maternal stress after delivery can hinder the establishment of successful breastfeeding practices.

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## Introduction

Breastfeeding has been recognized as a particularly beneficial practice for the health of newborns. Containing several anti-inflammatory components,

human breast milk, is the main source of passive and active immunity for newborns and it is particularly protective against morbidity and mortality (Hauck et al., 2011; Ivarsson et al., 2002; van Odijk et al., 2003; Walker, 2010). The World Health Organization (WHO, 2003) recommends exclusive breastfeeding, starting, ideally, within 1 h after delivery and lasting for at least 6 months, for the achievement of optimal maternal and infant

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health. The timely initiation of breastfeeding enhances the immunization of the newborn through the intake of colostrum and minimizes the risk for neonatal mortality (Edmond et al., 2006, 2007). Additionally early initiation of breastfeeding enhances the mother-infant communication and bonding (Renfrew et al., 2000). The beneficial effects of breastfeeding are evident beyond the lactation period but it can make a long-lasting contribution to protection against several diseases and to the cognitive development of children (Anderson et al., 1999; Kramer, 2010; Kramer and Aboud, 2008).

While breastfeeding is a protective factor against physical illness during childhood and later life, a growing body of research indicates that early maternal stress is a risk factor for developmental, behavioral, and emotional difficulties of offspring (Talge et al., 2007; Van den Bergh et al., 2005; Weinstock, 2005). For example, in two large prospective studies O'Connor et al. (2002; 2003) showed that higher maternal stress is associated with more behavioral problems of children at 47 and 81 months of age respectively.

Even though there is evidence that the health of the offspring can be positively influenced by breastfeeding practices and negatively influenced by maternal stress, the interplay between maternal stress and breastfeeding practices has rarely been examined (Dewey, 2001). Chen et al. (1998) was the only study to explore the influence of post-delivery maternal stress, on breastfeeding. They found that a long duration of labor, the stress of mother and fetus during labor, in addition to elevated cord glucose concentrations were related to the delayed initiation of first feeding, and a lower volume of breast milk. Further research is needed to examine the potential role of breastfeeding as moderator of the emerging link between maternal stress and the health of the offspring.

Thus, the aim of the present study is to investigate how maternal stress can influence the initiation and establishment of breastfeeding practices such as, initiation, duration, frequency of breastfeeding and milk volume.

## Methods

### Participants

A hundred and twenty pregnant women, who delivered in a university hospital of Greece between November 2009 and April 2010, were included in the study. All women had single births,

they were nonsmokers, they had a normal glucose-line during pregnancy, and they were not suffering from any coexisting pathology. They all delivered naturally at a gestation age >38 weeks. For the purposes of the present study, women were invited to participate only if they expressed an intention to breastfeed exclusively for at least one month. Thus the final study sample consisted of 95 women.

### Procedure

The study received approval from the local ethics committee and it was conducted in accordance with the Declaration of Helsinki (2002). Women were contacted on their last visit to the doctor. After detailed information regarding the purposes of the study, written consent of participation were obtained. After admission to the hospital, a medical and pregnancy history was obtained. During their stay, women did not receive any intravenous (IV) oxytocin or other medications, apart for epidural if needed. After delivery all women received the standard guidance by hospital nurses, regarding breastfeeding.

### Measures

#### Maternal stress

On the day of the delivery the stress levels of the mothers were measured using both physiological and self-reported psychosocial measurements. Objective assessments included cortisol levels taken from the umbilical cord blood immediately after delivery. Cortisol levels of mother were assessed because cortisol is routinely used as a biomarker of psychological stress (Vedhara et al., 2003). Ten minutes after delivery, cortisol levels were also measured also from the mother's blood. Blood samples were centrifuged and frozen at -20 C, until laboratory analysis. Cortisol was measured by an electrochemiluminescent cortisol immunoassay (ECLIA) (Elecsys E170, Roche Diagnostics, Switzerland, Basel) and expressed in mg/dL. Umbilical glucose was measured using an automated biochemical analyzer and expressed in mg/dL.

One hour after delivery, participants were asked to complete four questionnaires assessing exhaustion, positive and negative feelings about the baby, labor related traumatic stress and bonding with the baby.

Exhaustion was assessed using a Likert Scale ranging from 1 to 10, with higher scores indicating greater exhaustion.

The Positive Affect Negative Affect Scale was used to assess participants' negative and positive feelings concerning their baby (PANAS; Watson et al., 1988). The negative affect scale includes 10 items measuring negative emotions (e.g. 'sad'; 'nervous'), while the positive affect scale includes 10 items measuring positive emotions. The total score on each subscale consisted of the sum of all items (range: 10–50).

The Impact of Event Scale (IES, Horowitz et al., 1979), was used to assess labor-related traumatic stress. The scale classifies the impact of life events into two categories of stress reactions: intrusion (7 items) and avoidance (8 items). Participants were asked to consider all items in relation to memories of their delivery. A weighted frequency score was calculated by assigning the following weights to each item: 0 (not at all) for negative endorsement and 1, 3, 5 (rarely, sometimes often) for the three degrees of positive endorsement (Zilberg et al., 1982). A total score on traumatic stress was derived from the sum of all items (range 0–75).

The Mother- to- Infant Bonding Scale (Taylor, 2005) was used to measure mothers' bonding with their baby, 1 h after delivery and four days after. IBS contains 8 items, describing feelings that mothers usually have towards their baby the first weeks after delivery. A high total score indicates worse mother-to infant bonding.

### Lactation parameters

Four lactation parameters were explored in the present study, namely, initiation of lactation (in hours), duration of first feeding (min), milk volume (ml) and frequency of feedings (times/day). The time of the first lactation and its duration were recorded. The fourth day post partum, women were asked to collect the milk in order to calculate its total volume, within 24 h. An electric breast pump was used for milk collection and milk volume was measured with the use of a volumetric container. The mother had consented to provide her milk for volume measurement. For that feeding they were given the option to either provide formula, or give previously expressed milk by bottle. A lactation expert in the hospital, assisted in order for the breastfeeding process to be established smoothly. The frequency of feedings was recorded in the same day.

### Statistical analysis

Exploratory factor analysis using varimax rotation was performed on the four subjective stress indicators (negative feelings, labor-related

traumatic stress, and bonding, exhaustion) in order to create a new composite score, the Post Delivery Stress Score (PDSS).<sup>1</sup>

Univariate correlations using Pearson's coefficient were conducted to assess associations i) between objective and self-reported measures of stress; ii) objective indicators of stress and the four lactation parameters (initiation of lactation, milk volume, duration of breastfeeding and frequency of feeding); iii) Post Delivery Stress Score and lactation parameters.

Multiple regression analysis was performed with the four lactation parameters as dependent variables and PDSS, women's age and the administration of epidural during labor as the independent variables. All the statistical analyses were two-tailed and  $p < .05$  was considered to indicate statistical significance. The analyses were conducted using SPSS 18 for Windows (SPSS Inc. Chicago, IL).

### Results

Participants in the study had a mean age of 31 years ( $SD = 3$ ) and the mean gestational age (in weeks) was 39.6 ( $SD = .62$ ). No complications were reported during delivery. Regarding the lactation parameters, the mean initiation of feeding was after 51 min ( $SD = 22$ ), the mean feed frequency was 9 times/day ( $SD = .83$ ) and the mean milk volume was 661.20 ml ( $SD = 99$ ).

No significant correlation was found between the cortisol levels taken from the umbilical cord and the self-reported stress indicators. Mothers' blood cortisol levels were positively associated with labor traumatic stress ( $r = .513, p < .001$ ) and negative feelings ( $r = .503, p < .001$ ) and negatively associated with bonding ( $r = -.533, p < .001$ ). No association was found between cortisol levels and self-reported exhaustion. Regarding the association between women's cortisol levels and lactation parameters, no significant association was identified.

On the other hand, the composite score of the self-reported stress indicators, PDSS, was found to be positively associated with initiation of lactation ( $r = .420, p < .001$ ), negatively associated with milk volume ( $r = -.453, p < .001$ ) frequency of feedings ( $r = -.470, p < .001$ ) and duration of first feeding ( $r = -.520, p < .001$ ). Positive emotions were found to be associated with feed frequency ( $r = .21, p = .04$ ) and milk volume ( $r = .21, p = .046$ ).

<sup>1</sup> Detailed information regarding the factor analysis can be provided by the first author upon request.

Multiple regression analysis was performed to assess the influence of PDSS on milk volume, duration of lactation, initiation of lactation and frequency of lactation, after controlling for the influence of mother's age, and administration of epidural. As indicated in Table 1, after controlling for age and administration of epidural, PDSS was negatively related to milk volume, duration of first feeding, and frequency of feedings.

## Discussion

Several studies have examined the factors that exert a long lasting impact upon the health of offspring. Within these studies, breastfeeding has been recognized as a protective factor whereas maternal stress as a risk factor (van Odijk et al., 2003; Ivarsson et al., 2002; Walker et al., 2010; Hauck et al., 2011; van der Bergh, 2005; Weinstock, 2005; Talge et al., 2007). However, little is known about the interplay between maternal stress and breastfeeding. To our knowledge, this is one of the first studies attempting to explore the effect of maternal stress on breastfeeding practices.

The study shows that controlling for mothers age, and the use of epidural, post-delivery psychosocial stress is negatively related to all the breastfeeding parameters, namely, the initiation of lactation, milk volume, the frequency of feedings and the duration of first feeding. These findings indicate that maternal stress can be a risk factor for delayed onset and establishment of breastfeeding. They also suggest that breastfeeding

might be a potential moderator between maternal stress and the health of the offspring. It is likely that maternal stress can affect the offspring's health by compromising breastfeeding practices and reducing their beneficial and protective role for offspring's health. However, it is worth acknowledging that multiple factors may ultimately determine any link between maternal stress and child health outcomes, since stress is likely to impact a broad range of parental behaviors when interacting with their offspring.

In this study positive feelings were associated with increased feed frequency and milk volume. Positive feelings can be associated with increased levels of oxytocin in mothers (Mezzacappa and Katkin, 2002). Oxytocin is a lactation hormone that is associated with more positive mood in breastfeeding mothers, compared to bottle feeding mothers (Mezzacappa and Katkin, 2002). The link between oxytocin and lactation behavior in humans is still unclear but it can provide a possible explanation for the findings (Uvnäs-Moberg and Eriksson, 1996). Unfortunately, data on mothers' oxytocin levels were not collected in this study.

In addition, no association was found between the objective assessment of stress and any of the lactation parameters. Therefore we cannot exclude the possibility that the association between post delivery psychosocial stress score and lactation parameters is influenced by common method variance. Three out of four lactation parameters, namely, the initiation of lactation, the frequency of feedings and duration of first feedings were behavioral characteristics, whereas only milk volume is considered a biological marker

**Table 1** Standard multiple regression analysis with milk volume, feed frequency and duration of first feeding as dependent variables.

Dependent variable		Unstandardized coefficients		Standardized coefficients	<i>t</i>	<i>F</i>	<i>R</i> <sup>2</sup>
		B	SE B	Beta			
Milk volume (ml)	PDSS	-5.07	1.05	-4.84*	-4.85	18.451*	.362
	Age	8.80	2.28	3.86*	3.86		
	Epidural	-8.81	21.50	-.04	-.41		
Feed frequency (times/day)	PDSS	-.040	.01	-.40*	-4.16	13.90*	.313
	Age	.02	.02	.90	1		
	Epidural	-.50	.19	-.25*	-2.64		
Duration of first feeding (min)	PDSS	1.16	.22	.46*	5.22	21.431*	.414
	Age	-2.19	.48	-.37*	-4.53		
	Epidural	2.54	4.60	.050	.56		

\**p* < .001.

of lacto genesis. However, psychosocial stress was positively correlated with cortisol assessments, indicating that both measures gave a reliable depiction of mothers' stress after delivery. Additionally, psychosocial stress was assessed in "real time" immediately after delivery (10 min and 1 h later) resulting in reliable measures free of retrospective biases.

The findings of the study are of great interest because they suggest that stress can be a risk factor for delayed initiation of breastfeeding, lower milk volume and smaller frequency of feedings. The present findings suggest that interventions aiming at tackling the risk factors associated with difficulties in breastfeeding should also explore and address mothers' perceived stress after labor. Future studies are needed to explore whether prenatal stress has also an effect at breastfeeding practices. Additionally, future research should address whether maternal stress is associated with delayed initiation of lactation or shorter duration of breastfeeding as well.

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## Conflict of interest statement

None declared.

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