Breastfeeding and the mother–infant relationship—A review

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Abstract

A positive effect of breastfeeding on the mother–infant relationship is often assumed in the scientific literature, but this has not been systematically reviewed. This review aims to clarify the role of breastfeeding in the mother–infant relationship, which is conceptualized as the maternal bond toward the infant and infant attachment toward the mother. Our findings indicate that theoretical mechanisms through which breastfeeding may enhance the maternal bond or infant attachment (i.e., endocrine and sensory factors involved in breastfeeding) can be found in both humans and animal models. However, the few empirical studies investigating this association have not found convincing support for a relation between breastfeeding and the quality of the mother–infant relationship. We therefore conclude that assumptions on a positive role of breastfeeding on the mother–infant relationship are not supported by empirical evidence, and recommendation of breastfeeding should solely be based on its well-documented positive effects on infant and maternal health.

Introduction

Lactation is a defining characteristic of all mammals. In humans, breastfeeding has been related to improved maternal health (Labbok, 2001) and improved health and development of the infant (Anderson, Johnstone, & Remley, 1999; Caspi et al., 2007; Hanson, 1998). The positive effects of breastfeeding on the mother–infant relationship have also been widely advocated. This relationship can be envisioned as consisting of two complementary facets: the maternal bond, or the mother’s tie to her infant, and infant attachment, defined as the infant’s tie to its caregiver.

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Claims that breastfeeding positively affects the maternal bond and/or infant attachment have been put forward by various authors, not always accompanied by references or empirical evidence supporting such a claim. For example, a review on the benefits of breastfeeding concludes that “...breastfeeding enhances maternal–child attachment...” (Anholm, 1986, p. 8) without citing any scientific works relating breastfeeding to the maternal bond or infant attachment. More recent publications have made similar statements without providing empirical evidence (Aguayo, 2001; Leung & Sauve, 2005; Misri, Kostaras, Fox, & Kostaras, 2000). Furthermore, mothers report choosing breastfeeding over bottle-feeding to improve the mother–infant relationship (Arora, Mcjunkin, Wehrer, & Kuhn, 2000; Gijsbers, Mesters, Andre Knottnerus, Legtenberg, & van Schayck, 2005). These types of claims and beliefs may have an important psychological impact on mothers who are unable to nurse (due to, for instance, breast surgery or jaw malformation of the infant). In these mothers, assumptions of the positive effects of breastfeeding on the mother–infant relationship put forward by scientists and nursing staff can induce feelings of guilt (Crouch & Manderson, 1995; Zetterström, 1999). In fact, a UK study reported that mothers intending to bottle-feed were, according to self-reports, likely to be charged with being a bad mother (Murphy, 1999). Given these possible psychological consequences for non-breastfeeding mothers, the importance of sound scientific evidence on the relationship between breastfeeding and the mother–infant relationship becomes all the more apparent.

This review aims to clarify the role of breastfeeding in the (development of) the mother–infant relationship. We commence by summarizing current knowledge on the concept, development, and assessment of the maternal bond and infant attachment. We then theorize how endocrine and sensory factors involved in breastfeeding may enhance the maternal bond or infant attachment. We summarize and evaluate the empirical studies on the relations between breastfeeding and the maternal bond and infant attachment. We finish this review with a discussion on general methodological problems and possible future directions for studying breastfeeding and (the development of) the mother–infant relationship.

The mother–infant relationship: The maternal bond and infant attachment

The maternal bond and infant attachment: Definitions

We consider the mother–infant relationship as consisting of two complementary facets: the maternal bond, or the tie from mother to infant, and infant attachment, or the tie from infant to mother. Infant attachment entails the tie between infant and mother that develops from a distinct innate behavioral system, promoting mother–infant proximity (Bowlby, 1969/1982). The definition of the maternal bond is less clear. Klaus and Kennell (1976) introduced the term ‘maternal bonding’, defined as a biologically based emotional investment in the infant. After its introduction, the term ‘bonding’ and the related theories on it have received a fair amount of criticism (see next section). To prevent any confusion between the concept of the maternal bond and the theories related to ‘bonding’, we will hereafter refer to the tie from mother to infant as ‘the maternal bond’. Recent descriptions emphasize that the maternal bond is complementary to infant attachment, functioning to ensure maternal closeness to her infant (Maestripieri, 2001a). It is directed to a specific infant (Kendrick et al., 1997; Keverne, 2006), and it is characterized by the expression of a clearly defined set of maternal behaviors (Levine, Zagoory-Sharon, Feldman, & Weller, 2007). We propose a combination of these definitions and define the maternal bond as the tie from mother to infant that promotes maternal behaviors aimed at mother–infant proximity and caregiving. It develops from the distinct neurobehavioral circuitry underlying emotion and motivation (e.g., Leckman et al., 2004; Swain, Lorberbaum, Kose, & Strathearn, 2007).

The maternal bond and infant attachment: Background

The maternal bond was described by Klaus and Kennell (1976) as part of a research line that evolved mostly in response to the emerging medical procedures surrounding birth. Based on studies in ungulates and at-risk human populations, they proposed that a mother is biologically primed to
form an enduring emotional bond with her offspring. Furthermore, an essential part of their theory posed that a critical period exists for this bond to develop. The theory on a critical bonding period was heavily criticized because of its suggested homology with animal studies, flawed methodology, and overestimation of the permanence of the putative effects (Lamb, 1982; but also read Korsch, 1983; Lamb, 1983a, 1983b; Sugarman & Goldberg, 1983 for an interesting impression of the debate on the "bonding phenomenon"). Thus, although during the 1970's many articles on bonding, and more specifically, the existence of a critical bonding period, appeared in respected pediatric and medical journals (e.g., De Chateau, 1976; Grossman, Thane, & Grossman, 1981; Klaus et al., 1972; Ringer, Kennedy, Jarvella, Navajosky, & Klaus, 1975), “by the early 1980’s, research on the bonding of mothers and their newborns had been dismissed by much of the scientific community” (Eyer, 1992; for reviews on the research on a critical bonding period, see Lamb & Hwang, 1982; Myers, 1984).

Although research on the benefits of early post-partum contact was largely forgotten as a scientific area of interest after the 1970’s, with the realization that social bonds promote survival (Carter & Kenneweke, 2002; Miller, Feldman, & Pasta, 2002), and that maternal caregiving, by providing protection and nurturing, allows a longer period of (brain) development, research on the maternal bond and factors affecting its development has more recently been renewed (e.g., Feldman, Weller, Leckman, Kuin, & Eidelman, 1999; Leckman et al., 2004). However, unlike the bonding research in the 1970’s, Feldman and colleagues focus their research on “a clearly defined set of maternal post-partum behaviors that emerge or intensify during the bonding stage” (Levine et al., 2007), and more clearly theorize on and investigate the biological basis of the maternal bond (e.g., Leckman et al., 1999; Leckman et al., 2004; Levine et al., 2007).

One of the major features of the attachment theory is the concept of attachment as an innate behavioral system with the biological function of protection that has been built into humans and other primates through natural selection (Bowlby, 1969/1982). The attachment behavioral system predisposes infants to display attachment behaviors (such as crying, smiling, vocalizing, approaching, and following) that serve to increase proximity to the caregiver, particularly in times of distress.

Infants become attached to caregivers with whom they regularly interact and whom they can resort to in times of distress. Only if no opportunity for ongoing interaction with a specific caregiver exists, will there be a failure to attach, such as in the case of some institutionalized children (O’Connor, Bredenkamp, & Rutter, 1999). Although an infant forms one primary attachment (usually to the mother), it may also become attached to other caregivers, such as the father, grandparents or non-familial caregivers (Ahnert, 2006; Hrdy, 1999).

Whereas nearly all infants become attached to their primary caregivers, not all are securely attached. A securely attached infant is able to use the caregiver as a secure base for exploration and the attachment figure functions as the ‗outer ring‘ of homeostasis for the infant, acting as a buffer against distress (Ahnert, Gunnar, Lamb, & Barthel, 2004; Bowlby, 1973; Spangler & Grossman, 1993). When distressed, the secure infant quickly and effectively seeks contact with the caregiver and remains in contact as long as needed; after reassurance, which mostly does not take long, the securely attached infant contently returns to play. Insecurely or anxiously attached infants, on the other hand, cannot use their caregiver as a secure base for exploration; they resist or avoid contact with the caregiver, and it takes longer for them to recover from distress and return to exploration than for securely attached children (for a description of different types of insecure attachment, see Ainsworth, Blehar, Waters, & Wall, 1978; Main & Solomon, 1990).

Longitudinal research has shown that the security of an infant’s attachment to a caregiver is associated with the history of its interactions with that caregiver. Securely attached children have been found to have caregivers who sensitively and consistently respond to the children’s attachment behaviors (De Wolff & Van IJzendoorn, 1997; Nievar & Becker, 2008; Van den Boom, 1994). Infants with insecure attachment relationships, on the other hand, have not experienced consistent availability and comfort from their caregivers when distressed. Instead, they have experienced unresponsiveness, intrusiveness, rejection, or unpredictable and frightening behavior on the part of their caregivers, which makes them anxious about the availability of the attachment figure and leads to angry, avoiding, or disorganized behavior when experiencing distress in the presence of the caregiver (Weinfeld, Sroufe, Egeland & Carlson, 1999).
The maternal bond and infant attachment: Development

The maternal bond and infant attachment develop over time. Concerning the maternal bond, Miller and Rodgers (2001) propose that the ‘nurturant bonding system’ that promotes care to infants, develops around puberty, in tandem with sexual development, and continues to develop through adult life. Although this system does not promote directing care at a specific infant, and thus does not constitute a maternal bond, it is important because one of the most important factors predicting proper maternal caregiving and motivation would be experience in caregiving (Fleming, 2006). Thus, although development of the maternal bond by definition cannot start before pregnancy, it may be stimulated by caregiving experience prior to pregnancy (e.g., Hrdy, 2006). Regarding the maternal bond, Winnicott (1975) already suggested how “primary maternal preoccupations” began at the end of pregnancy and continued through the first months after birth. Klaus and Kennell (Klaus & Kennell, 1983; Klaus, Kennell, & Klaus, 1995) state that the bonding process starts during pregnancy and continues to develop throughout the first years. Although this theory has, according to Tessier et al. (1998, p. 18), “withstood the test of time”, experimental support has so far been little (see Maestripieri, 2001b). While circumstantial evidence provided by the ‘La Maternité’ experiment indicates that a mandatory post-partum caregiving period in at-risk mothers may promote maternal motivation (as noted in Fuchs & Knepper, 1989), others have found that the development of the maternal bond is far from inevitable. Corter and Fleming (2002) review evidence that pre-birth maternal motivation may not be experienced by all mothers. Feldman et al. (1999) provide evidence that formation of the maternal bond may be hampered by impending loss and Leckman et al. (1999) found that aspects of the maternal bond (maternal preoccupation) intensified after birth but then declined after 3 months. Evidence of a fMRI study by Swain et al. (2004), supports the findings by Leckman et al.: in primiparous mothers the brain response to infant crying changes. The response indicative of alarm decreases during the first months post-partum, but it is replaced by a response indicative of social engagement, suggesting that rather than weakening after three months, the maternal bond develops and changes in form.

Regarding infant attachment, in the first few weeks after birth, a period termed the “pre-attachment phase” by Ainsworth et al. (1978, p. 23), babies orient and signal to people without discrimination of figure (Bowlby, 1969/1982). Soon thereafter, during “attachment-in-the-making” (Ainsworth et al., 1978, p. 24), they begin to show discrimination in directing their various attachment behaviors to different figures, and these figures may also differ in how readily they can terminate an attachment behavior, such as crying. By the end of the first year of life, most babies have formed a “clear-cut attachment” (Ainsworth et al., 1978, p. 25) to one or more specific caregivers; they not only show simple preference of these figures over others, but also actively seek and maintain proximity and contact with their attachment figures and react with distress to separation (Bowlby, 1969/1982). Although a clear-cut attachment has been formed at the end of the first year, attachment security can change during infancy, childhood, and adolescence when the family environment changes (Thompson & Raikes, 2003; Waters, Weinfeld, & Hamilton, 2000).

Taken together, our initial definition of the maternal bond suggests that it may bear many similarities to infant attachment. We emphasize, however, that although both concepts share aspects related to cause (innateness, neurobehavioral origin; Insel, 1997; Miller & Rodgers, 2001) and effect (promoting survival of the offspring), both differ in their behavioral output (seeking vs. offering care), and may differ in their developmental trajectory. Whereas it is clear that infant attachment develops during the first year, and may change when the family situation is altered, we know very little about the development of the maternal bond. Clearly, more research is needed to further elucidate the processes involved in the development of the maternal bond.

The maternal bond and infant attachment: Scientific assessment tools

Psychological research on the dyadic mother–infant relationship has mainly focused on infant attachment, yielding a number of scientific assessment tools, while the available methods to investigate the maternal bond are limited.

The emotional aspect of the maternal bond has been assessed through questionnaires, e.g., the Parental Bonding Questionnaire (PBQ: Brockington et al., 2001) or the Parenting Stress Index (PSI:
Abidin, 1986), self-report (e.g., Wojnar, 2004), or structured observation (e.g., Cernadas, Noceda, Barrera, Martinez, & Garsd, 2003; Martone & Nash, 1988). All of these approaches have benefits and problems that may affect the outcome, and none has been used in more than a handful of studies to study the maternal bond. For example, the PSI has been widely used to assess parenting stress, but to our knowledge, only one study has used it to specifically assess the maternal bond (Else-Quest, Hyde, & Clark, 2003).

In attachment research, the Strange Situation Procedure (SSP, Ainsworth et al., 1978) is by far the most widely used procedure to assess the quality of the attachment between infant and caregiver (Solomon & George, 1999). The SSP is a structured 20-min laboratory procedure designed to assess by means of observation whether infants use the caregiver as a secure base under conditions of moderate but increasing stress, such as the entrance of a stranger and separation from the caregiver. Based on their behavior during the SSP, infants are classified into one of four attachment categories, one “secure” category (B), and three different “insecure” categories (A, C, and D). In a review on the origins of attachment theory, Bretherton (1992, p. 767) notes that “it often seemed as if attachment and the Strange Situation had become synonymous”. The SSP however is not a paradigm suitable for determining attachment security in all populations. Due to its stressfulness it is less useful for use in clinical populations that are vulnerable to stress (such as depressed mothers and their infants) and the procedure may be too stressful in cultures where caregiver–infant separations are uncommon. Furthermore, the SSP is designed for use in infants between the age of 12 and 24 months.

To overcome some of these limitations, Waters and Deane (1985) designed the Attachment Q-Set (AQS) that assesses the security of the infant–caregiver attachment relationship in the (non-stressful) home setting. The AQS can be used in children from 12 to 60 months and consists of 90 cards describing specific behavioral characteristics of children. After having observed the infant for an extended period of time, a trained observer sorts the cards into nine stacks, ranging from ‘most descriptive of the child’ to ‘least descriptive of the child’. A security score ranging from −1.0 (prototypically insecure) to +1.0 (prototypically secure) can subsequently be calculated by correlating the child’s profile with that of a prototypically secure child as provided by experts in the field (Waters & Deane, 1985). In a large meta-analysis of 139 AQS studies, Van IJzendoorn, Vereijken, Bakermans-Kranenburg, and Riksen-Walraven (2004) concluded that the AQS shows sufficient validity to be considered an appropriate measure of the attachment security of infants and toddlers.

Theoretical support for a role of breastfeeding in the mother–infant relationship

Breastfeeding differs from bottle-feeding in a variety of ways. The hormones that stimulate milk production and milk ejection have, in animal models, been shown to affect maternal caregiving behavior and pair bonding. Furthermore, non-nutritive features of the mother–infant interaction during breastfeeding may promote infant attachment. Thus, breastfeeding may, in theory, affect the maternal bond or infant attachment.

In this section, we will discuss how factors inherent to breastfeeding may promote the maternal bond and infant attachment. We will focus on two potential mechanisms: effects of breastfeeding on the maternal bond by the hormones involved in breastfeeding, and effects of breastfeeding on infant attachment by non-nutritive aspects associated with a typical mother–infant breastfeeding interaction.

Breastfeeding and hormones: Potential effects on the maternal bond

Breastfeeding affects the endocrine system of the mother (for a review, see Buhimschi, 2004). Specifically, the small peptide hormone oxytocin (OT) is released in a pulsatile fashion in response to suckling (Nissen et al., 1996; Ueda, Yokoyama, Irahara, & Aono, 1994, but see Uvnäs-Moberg, 1998, for a review). OT stimulates the contraction of smooth muscle cells and the release of milk from the mammary gland. Prolactin (PRL), another peptide hormone, stimulates milk secretion in mammary tissue (Neville, McFadden, & Forsyth, 2002) and is released after suckling (Johnston & Amico, 1986). The endocrine response to breastfeeding primarily serves to support milk production, but animal research
has shown that it may play an essential role in promoting the maternal bond (as reflected by the occurrence of maternal caregiving behavior). In the following sections, we will briefly review studies examining the role of oxytocin and prolactin in maternal caregiving behavior and the maternal bond.

**Oxytocin**

OT can potentially affect the maternal bond. Kendrick (2000) reviewed the effects of OT on maternal caregiving behavior in animals and suggested that OT both activates behavior beneficial for infant survival and suppresses behavior that might harm the offspring. Due to the fact that bond formation is said to occur in situations in which OT plays a critical role, such as parturition, OT was already suggested to regulate social bond formation over 20 years ago (Klopf, 1971).

In non-primate mammals, there is evidence that OT induces the onset of maternal caregiving behavior in hormonally primed females. Female rats (Pedersen, Caldwell, Walker, Ayers, & Mason, 1994) and sheep (Da Costa, Guevara-Guzman, Ohkura, Goode, & Kendrick, 1996; Kendrick, Keverne, & Baldwin, 1987) can be induced to display maternal caregiving behavior by intracerebroventricular OT administration, while an injection of OT antagonist in rats shortly after parturition impairs the onset of maternal caregiving behavior (Van Leengoed, Kerker, & Swanson, 1987). It has been suggested that variation in OT receptor density in various brain regions may underlie both species and individual differences in alloparental care in rodents (Olazábal & Young, 2006). Furthermore, while OT is not essential for maternal caregiving behavior to occur after its onset (Insel, 1997; Pedersen, 1997), the amount of pup licking and grooming in rats is positively affected by post-partum levels of OT (Champagne, Diorio, Sharma, & Meaney, 2001; Francis, Champagne, & Meaney, 2000). Thus, OT induces the onset of maternal caregiving behavior in rats and sheep, and after its onset some forms of maternal caregiving behavior may continue to be affected by OT levels.

In non-human primates, studies suggest that OT facilitates maternal caregiving behavior (Boccia, Goursaud, Bachevalier, & Pedersen, 2005; Holman & Goy, 1995). Recent preliminary findings by Boccia, Goursaud, Bachevalier, Anderson, and Pedersen (2007) indicate that administration of an OT antagonist reduced maternal behavior in a nulliparous female rhesus monkey, providing further support for this notion. Pedersen (2004), however, suggests that in primates, maternal caregiving behavior is less determined by hormonal control, but instead is mainly acquired through early learning and social experience. This suggestion is in line with findings summarized in a review by Insel (2003) who proposes a role for OT in linking external social signals to brain structures involved in motivation and reward, rather than activating maternal behavior. The maternal bond, therefore, may be the result of the motivation and rewards associated with carrying out maternal caregiving behavior, as was previously suggested by Panksepp, Nelson, and Siviy (1994).

In further support of a role of motivational systems in the maternal bond, Bartels and Zeki (2004) found that the periaqueductal gray area is activated when human mothers are exposed to pictures of their own children, as opposed to pictures of adults or unfamiliar children. Interestingly, the periaqueductal gray area is rich in OT receptors (Jenkins, Ang, Hawthorn, Rossor, & Iversen, 1984), has been associated with opioid-stimulated maternal caregiving behavior in rat mothers (Miranda-Paiva, Ribeiro-Barbosa, Canteras, & Felicio, 2003), and plays an important role in drug withdrawal and dependence (see Christie, Williams, Osborne, & Bellchambers, 1997 for a review). In further support, infant crying induces brain activity in the ventral tegmental area of mothers and the authors note that “crying infants, [...]” (Lorberbaum et al., 2002, p. 442). Taken together, these findings indicate that the brain mechanism that promotes a proper response to infant stimuli shares its neural substrate with brain addiction centers. It may therefore be that maternal caregiving behavior itself is rewarding, much like appetitive behaviors (see Spruijt, van den Bos, & Pijlman, 2001), and that the maternal bond is a result of expressing maternal caregiving behavior toward the infant (as suggested by Panksepp et al., 1994).

Actual experimental research on the effects of OT on the maternal bond in humans is, because of the obvious ethical constraints, non-existent. Recently, however, an observational study by Levine et al. (2007) has shown that basal peripheral oxytocin concentrations in human mothers are related to both maternal behavior and maternal bond. They sampled peripheral oxytocin during pregnancy and the first month post-partum and found that oxytocin concentrations were fairly stable over time.
and that they positively correlated with the quality of both maternal behavior and the maternal bond as reported in the Yale Inventory of Parent Thought and Action (YIPTA) questionnaire. Animal studies on the effects of OT on the maternal bond are rare, possibly due to the fact that rodent mothers display no special preference for their own offspring but instead ‘bond’ with young pups in general (Pedersen, 2004). However, pair bonding, which may be functionally similar to the maternal bond (Carter, 1998; Insel, 1997), has been studied extensively in the prairie vole, a rodent species that, in contrast with the closely related montane vole, displays monogamous pair bonds. OT plays an essential role in the bond formation process, as central administration of OT to female prairie voles facilitates pair bonding while OT antagonist administration impairs pair bonding (Insel & Hulihan, 1995). Moreover, the OT receptor distribution in female montane voles resembles that of prairie voles only when parental behavior is present (Insel, 1997; for a review: Wang & Aragona, 2004).

In sum, there is reasonable evidence that OT-mediated mechanisms may promote maternal caregiving (as a reflection of the maternal bond) through reward-related mechanisms.

**Prolactin**

The role of PRL in maternal caregiving behavior has been extensively reviewed (González-Mariscal & Poindron, 2002; Mann & Bridges, 2001) and will only be briefly discussed. Studies show that administration of PRL hastens the onset of maternal caregiving behavior in nulliparous, hormonally primed rats (Bridges, DiBiase, Loundes, & Doherty, 1985), while inhibiting PRL secretion or blocking PRL receptors delays it (Bridges, Numan, Ronsheim, Mann, & Lupini, 1990; Bridges, Rigero, Byrnes, Yang, & Walker, 2001). While steroid treatment alone will induce maternal caregiving behavior in rats, only the presence of PRL during steroid treatment will sustain some maternal caregiving behaviors until 7 days post-partum (Orpen, Furman, Wong, & Fleming, 1987). Also, maternal PRL levels positively correlate with the amount of maternal caregiving behavior displayed by rat dams in response to ultrasonic vocalizations of rat pups (Hashimoto, Saito, Furudate, & Takahashi, 2001), indicating that the importance of PRL in rat maternal caregiving behavior extends beyond its onset.

The first study on the role of PRL in caregiving behavior in primates describes how carrying offspring increases PRL levels in male marmosets (Dixon & George, 1982), but these findings do not indicate a direction of the effects. Similar effects have been found in male tamarins and marmosets (Roberts et al., 2001a; Schradin, Reeder, Mendoza, & Anzenberger, 2003), and female marmosets (Roberts et al., 2001a), female squirrel monkeys (Soltis, Wegner, & Newman, 2005), and female cotton-top tamarins (Ziegler & Snowdon, 2000). So far, the only study indicating a directing rather than corollary role of PRL on maternal caregiving behavior comes from Roberts et al. (2001b), who suggest that blocking of PRL secretion inhibits infant retrieval in both male and female common marmosets. A recent study by Almond, Brown, and Keverne (2006), however, indicates that suppression of PRL does not affect paternal caregiving in experienced male common marmosets.

In human fathers, a positive correlation between PRL levels and couvade (male pregnancy) symptoms has been found (Storey, Walsh, Quinton, & Wynne-Edwards, 2000). Experienced fathers show a greater increase in PRL than inexperienced fathers after they hear an infant cry, and fathers with higher baseline PRL levels respond more alertly to infant hunger cries (Fleming, Corter, Stallings, & Steiner, 2002). This suggests a functional directing mechanism through which PRL mediates paternal care, and that caregiving experience may correlate with a greater prolactin-mediated sensitivity to infant stimuli. However, while a correlation between PRL levels and paternal behavior has been found, little evidence exists for a similar mechanism in human mothers. This may be due to methodological difficulties, because PRL levels in puerperal mothers may be caused by infant contact or post-partum endocrine processes. Because of the postulated homology between male and female neuroendocrine circuitries (Wynne-Edwards, 2001), a role of PRL in the onset and maintenance of maternal caregiving behavior is possible and further studies in, for instance, non-lactating mothers or young females should be undertaken to determine whether this relationship exists in human mothers or females in general.

In sum, while a role of PRL in maternal caregiving is likely, this relation has not been investigated in human mothers. It is unclear whether PRL directly affects the maternal bond, but we note that the maternal caregiving that may be promoted by PRL may indirectly promote both the maternal bond and infant attachment.
Non-nutritive aspects of breastfeeding: Potential effects on infant attachment

In addition to the (endocrine) effects of breastfeeding that may promote maternal caregiving behavior and bond formation, non-nutritive aspects of breastfeeding may promote infant attachment. Breastfeeding allows the mother to know what her infant is doing through direct sensory feedback, potentially promoting attachment through better attunement of mother–infant feeding interactions. An important predictor of later infant–mother attachment is the mother’s sensitivity toward her infant’s behaviors (De Wolff & Van IJzendoorn, 1997; Nievar & Becker, 2008; Van den Boom, 1994). Formation of a secure attachment is stimulated by a sensitive and consistent response to the infant’s signals. While breastfeeding may offer the infant distinct visual, tactile and olfactory stimuli, it may also affect the mother’s behavior during feeding (Note: by the mother’s behavior, we do not mean maternal caregiving behavior, but rather her general behavior), thus offering the suckling infant different interactive experiences with the mother.

Direct feedback through nipple stimulation may promote mother–infant attunement during feeding interactions. Attunement, defined as the mutual adjustment of emotional and attentive states, can be considered a key element of maternal sensitivity, and as such, attunement has been found to contribute to later attachment security (Feldman, 2007; Jaffe, Beebe, Feldstein, Crown, & Jasnow, 2001; Schore, 2000, 2001a, 2001b; Siegel, 2001). Correlations between interaction synchrony, defined as the extent to which an interaction is reciprocal and mutually rewarding and therefore a measurable index of attunement, and later attachment security were found when the mother–infant interaction was observed at as early as one month of age (Isabella & Belsky, 1991; Isabella, Belsky, & von Eye, 1989).

In addition to potentially fostering maternal sensitivity and mother–infant attunement, breastfeeding has been shown to positively affect maternal emotion (Mezzacappa, 2005, for a review). For example, breastfeeding increases maternal satisfaction (Kavanaugh, Meier, Zimmermann, & Mead, 1997), and it has also been suggested that breastfeeding might decrease negative mood, while bottle-feeding would decrease positive mood (Mezzacappa & Katkin, 2002). Uvnäs-Moberg (1996) postulates that breastfeeding has a calming effect on mothers. This has been later supported by Heinrichs et al. (2001), who suggest that breastfeeding increased calmness as tested by a questionnaire. These data are supported on a physiological level: mothers have a dampened stress response to both physical and psychological stressors directly after breastfeeding (Altemus, Deuster, Galliven, Carter, & Gold, 1995; Amico, Johnston, & Vagnucci, 1994; Heinrichs et al., 2001), an effect that may be mediated by the hormonal response to breastfeeding (Heinrichs, Baumgartner, Kirschbaum, & Ehler, 2003; Light et al., 2000). Other experiments suggest that the pulsatile patterns of OT release that are characteristic of breastfeeding are associated with a desire to please and interact socially (Nissen, Gustavsson, Widstrom, & Uvnäs-Moberg, 1998; Uvnäs-Moberg, Widström, Werner, Matthiesen, & Winberg, 1990). Interestingly, the amount of milk given to the infant during breastfeeding also correlated with this desire for socialization (Uvnäs-Moberg, 1997). In sum, there is evidence that by breastfeeding, mothers may become calmer and more sociable, which in turn may promote attachment security.

Empirical studies on breastfeeding and the mother–infant relationship

A literature search was carried out in PsychInfo, Medline, and the International Bibliography for the Social Sciences for papers published after 1985 and written in English, combining the terms “bond” and/or “attachment” with “breast?feed”. The initial search yielded 328 papers, which, after reading the abstract of each paper and eliminating duplicate results, was reduced to 41 papers mentioning a relation between breastfeeding and the maternal bond or attachment. Out of these 41 papers, 22 papers make general statements on the positive effect of breastfeeding on either facet of the mother–infant relationship without a reference to empirical studies supporting this claim. In 13 papers, the reasons why parents choose to breastfeed their children are empirically examined. These papers generally conclude that parents reported better bond formation through breastfeeding or that improved bond formation was a reason for starting or extending breastfeeding. For example, Gijsbers et al. (2005) conclude that “The most important influencing factors regarding initiation and continuation
of breastfeeding were... bonding". While these papers provide valuable information regarding parental reasons for providing breastfeeding, they do not directly examine the relation between breastfeeding and the quality of the mother–child relationship.

Finally, six empirical studies directly examined the association between breastfeeding and either the maternal bond or infant attachment. These studies are summarized in Table 1 and will be discussed in the following paragraphs.

As shown in the table, three studies related breastfeeding to the maternal bond. In the study by Cernadas et al. (2003), the quality of the mother–infant bond was rated by three experienced observers during the first days after birth. A better bond was significantly correlated with a longer duration of exclusive breastfeeding, as assessed by monthly telephone interviews during the first 6 months of life. The correlation should be interpreted with caution, however, because the study was set up to examine the effect of the maternal bond on breastfeeding, and not the effect of breastfeeding on the maternal bond. However, these findings do indicate that studies on the relation between the occurrence of breastfeeding and the quality of the mother–infant relationship need to take into account the reciprocity of the relationship; breastfeeding may promote the maternal bond, but mothers who bond better with their infants may also be more likely to choose to breastfeed over bottle-feeding.

In a study in mothers who exclusively breastfed or bottle-fed from birth, Martone and Nash (1988) found no relation between feeding method and maternal affective behavior during a feeding interaction at two days post-partum. Using the Avant maternal–infant attachment tool, Martone and Nash observed 15 breastfeeding and 15 bottle-feeding mother–infant pairs during a feeding session in the hospital. Their choice for observing at 2 days post-partum may have been motivated by the ongoing debate on a critical bonding period, and, unfortunately, the maternal bond was not assessed at later ages. If breastfeeding does affect bond formation, differences are to be expected after some time. Thus, while neonatal measures of the maternal bond are important for providing a 'basal' score, effects of breastfeeding on the maternal bond can only be determined through later assessments.

The third study relating breastfeeding to the maternal bond was performed by Else-Quest et al. (2003) who reported a weak and non-significant relationship between breastfeeding and the maternal bond. In their longitudinal study, breastfeeding and bottle-feeding mothers filled in the Parenting Stress Index at 4 and 12 months post-partum, which includes a scale on maternal attachment. At 4 months post-partum, breastfeeding mothers showed a non-significant tendency to score lower on the maternal attachment scale than bottle-feeding mothers, indicating a better bond. When retested at 12 months, no differences between breast- and bottle-feeding mothers were found. The reverse was found with regard to the quality of the parent–child interaction, which was videotaped at home at 4 and 12 months and rated using the Parent–Child Early Relational Assessment (PCERA; Clarke, 1985). While breastfeeding mothers did not differ from bottle-feeding mothers at 4 months, some differences were found at 12 months. Bottle-feeding mothers showed significantly more negative affect and behaved more intrusively than breastfeeding mothers, and their infants displayed more dysregulation and irritability as compared to the infants of breastfeeding mothers. Else-Quest et al. further elaborate on their findings stating that although there were differences between breast- and bottle-feeders, bottle-feeding mothers scored well within the range of scores corresponding to good-quality relationships on the PCERA.

As shown in Table 1, three empirical studies have investigated the relation between breastfeeding and children’s attachment. In the earliest study, Fergusson and Woodward (1999) examined the association between breastfeeding and the parent–child relationship in a large cohort of children (N = 999). From birth to 1 year of age, information was collected on maternal breastfeeding practices, and at 15–18 years of age the children themselves filled out the Inventory of Parent and Peer Attachment (IPPA), a questionnaire that is designed to measure the quality of children’s attachment to their mother, father, and peers (separate scores). In Fergusson and Woodward’s study, the scores for attachment to mother and father were combined into one overall score for the quality of attachment to both parents. The children were classified into four groups: no breastfeeding (29.6% of the sample), <4 months (27.1%), 4–7 months (19.4%), and >7 months (23.8%). Fergusson and Woodward report that breastfeeding duration was significantly associated with higher quality attachment to parents, but after adjusting for confounders, the effect of breastfeeding duration disappeared. It should be noted that some important methodological constraints may have compromised the outcome of this study.
### Table 1
Overview of studies on breastfeeding and the mother–infant relationship

<table>
<thead>
<tr>
<th>Authors</th>
<th>Bonding/attachment</th>
<th>Assessment instrument</th>
<th>Infant age at assessment of Bonding/attachment</th>
<th>N</th>
<th>Breastfeeding measures</th>
<th>Confounding demographic measures</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cernadas et al. (2003)</td>
<td>Bonding</td>
<td>Observation (Self-designed) Maternal report (Questionnaire, PSI)</td>
<td>&lt;3 days</td>
<td>529</td>
<td>Duration, Initiation</td>
<td>Age, Parity, Education, Age, SES, Education*</td>
<td>A longer duration of exclusive breastfeeding was associated with good mother–infant bonding</td>
</tr>
<tr>
<td>Else-Quest et al. (2003)</td>
<td>Bonding</td>
<td>Maternal report</td>
<td>4 months, 12 months</td>
<td>570</td>
<td>Initiation</td>
<td>Age, SES, Education*</td>
<td>Non-significant tendency of breastfeeders to report experiencing better bonding with their infant at 4 months. No differences at 12 months</td>
</tr>
<tr>
<td>Martone and Nash (1988)</td>
<td>Bonding</td>
<td>Observation (AVANT)</td>
<td>2 days</td>
<td>30</td>
<td>Initiation</td>
<td>None reported</td>
<td>No significant differences between breast- and bottle-feeding mothers</td>
</tr>
<tr>
<td>Britton et al. (2006)</td>
<td>Attachment</td>
<td>Observation (SSP)</td>
<td>12 months</td>
<td>152</td>
<td>Initiation, Duration</td>
<td>Age*, SES*, Education, Ethnicity</td>
<td>No relationship between breastfeeding and attachment security</td>
</tr>
<tr>
<td>Gribble (2006)</td>
<td>Attachment</td>
<td>Maternal report (Unstructured interview)</td>
<td>Varying (6 months to 5 years)</td>
<td>4</td>
<td>Initiation</td>
<td>None reported</td>
<td>Although not statistically tested, a role of breastfeeding in promoting infant attachment is suggested</td>
</tr>
<tr>
<td>Fergusson and Woodward (1999)</td>
<td>Attachment</td>
<td>Child report (Questionnaire, IPPA)</td>
<td>15–18 years</td>
<td>999</td>
<td>Initiation, Duration</td>
<td>Age*, Parity*, SES*, Education*</td>
<td>After adjustment for demographic factors, breastfeeding was not related to perceived attachment to parents</td>
</tr>
</tbody>
</table>

Confounding Demographic Factors noted with * were significantly different between breast- and bottle-feeding populations. When significantly different, breastfeeding populations were older, multiparous, had higher education levels and SES, and were not part of an ethnic minority. In all studies, significantly different confounders were always controlled for.
By measuring attachment only when the children were 15–18 years of age, a possible transient effect of breastfeeding on attachment could not be detected. Furthermore, effects of other potential determinants of attachment, such as non-feeding-related mother–child interactions and significant life events in the intervening period, were not controlled for. And finally, while breastfeeding is an interaction between the mother and her infant, the child's attachment to both parents was taken as an outcome measure in this study.

Gribble (2006), in a review on breastfeeding and attachment, presents four case studies in which breastfeeding promoted attachment in adopted infants. However, while these cases are intriguing, we are of the opinion that this study does not provide sufficient evidence of a role of breastfeeding in infant attachment. The four presented case studies all involve abused or neglected infants, and the quality of the attachment relationship was not determined using the SSP or AQS, but was based on maternal report. Finally, no cases of comparable, but non-breastfed, infants were presented, and thus the relative effect of breastfeeding is difficult to estimate, especially because adopting mothers who decide to breastfeed are likely to differ from the average population in other respects that may promote infant attachment.

The third and final study relating breastfeeding to infant attachment is reported by Britton, Britton, and Gronwaldt (2006). This study was the first to examine breastfeeding in relation to infant attachment security as assessed with the Strange Situation Procedure. Britton et al. assessed breastfeeding intent (prenatally), and breastfeeding practice (initiation and duration) up to 12 months post-partum. Maternal sensitivity toward the infant during feeding was rated from videotape at 3 months and the quality of the mother–infant interaction was also rated at 6 months. Finally, the mother–infant dyads \((n = 152)\) were observed in the Strange Situation. The results indicate that both breastfeeding intent and breastfeeding practice were positively correlated with maternal sensitivity at 3 months post-partum. However, Britton et al. did not find a relationship between breastfeeding practice and infant attachment: securely and insecurely attached dyads did not differ in breastfeeding initiation or duration. While the results of this study do not completely eliminate the possibility that breastfeeding has an effect on infant attachment, they do strongly indicate that if breastfeeding affects infant attachment, it will be a small effect at most.

Summarizing, there are few studies on the relation between feeding method and the maternal bond or infant attachment, and the findings of the studies that do explore a potential relation are inconclusive at most. It is, however, noteworthy that both Else-Quest et al. (2003) and Britton et al. (2006) find that breastfeeding is associated with differences in the quality of the interaction between mother and infant, with breastfeeding mothers doing better in both studies. The fact that no conclusive relation between feeding method and the mother–infant relationship has been found may indicate that breastfeeding is of little importance to the mother–infant relationship. However, given the importance of infant attachment for future development, and the consequences of poor maternal care for infant well being and development, we feel that it is warranted to discuss whether the absence of empirical support for a role of breastfeeding in the mother–infant relationship indicates that no such relationship exists, or whether it may be the result of methodological issues, because theoretical grounds on which an effect of breastfeeding on the maternal bond or infant attachment exist. The following section therefore discusses general methodological constraints that may have hindered previous studies, at the same time offering possible solutions for future studies.

**General methodological constraints**

As previously shown, there are theoretical mechanisms through which breastfeeding may promote the maternal bond or attachment. However, scientific support of this assumption is scarce. Again, this could indicate that breastfeeding does not affect the maternal bond or infant attachment, but may also be the result of the general lack of empirical studies on the subject and of methodological problems of these studies. In this section, we will further discuss general methodological issues concerning research on breastfeeding practice, the maternal bond, and infant attachment that may provide an alternative explanation for the lacking relationship.
Breastfeeding

Modern human breastfeeding practice has changed to such an extent that the validity of animal research data that supports a possible role of breastfeeding in promoting the mother–infant relationship is uncertain. We argue that in order to assess the importance of breastfeeding for the mother–infant relationship, studies should carefully report the specifics of breastfeeding behavior, such as overall duration and number of feeds per day, in order to better specify which factors do or do not exert any effect. To this end, we will shortly discuss studies explaining why these factors are of relevance.

The importance of taking breastfeeding duration into account becomes apparent when comparing human and non-human primate nursing duration. Primate studies show that the young are weaned when their birth weight has tripled (in humans after approximately 3 years) or after they reach about six times their gestation length (in humans after 4.5 years, Dettwyler, 1995; Dettwyler, 2004). However, while the World Health Organization encourages exclusive breastfeeding for the first 6 months post-partum and continuation of breastfeeding until 2 years of age, there is evidence that in western society breastfeeding duration can be even shorter. For example, current US data indicate that while 70% of mothers start breastfeeding, only 33% continue to do so until the child is 6 months of age. Bearing in mind the developmental window of infant attachment, which only starts to become person-specific after approximately 3 months and is still in full development during the second 6 months after birth, this may be very relevant. Therefore, it is possible that no effects on infant attachment are to be expected when breastfeeding durations are very short.

Another factor that should be taken into account is the number of daily feeds, as an indication of whether infants are fed on-demand or at scheduled intervals. Ben Shaul (as cited in Blurton Jones, 1972) notes that the composition of human milk, i.e., low protein and fat content, is indicative of a continuous, on-demand, feeding schedule, as is seen in a multitude of tribal cultures. According to Filides (1986), breastfeeding frequency in Europe mostly followed the infant’s needs until approximately 1750 AD, when English society women started scheduling their feeding regime in order to combine motherhood and social responsibilities. The practice of scheduling feeds has continued in western civilization in order to accommodate working mothers, although on-demand feeding is gaining popularity in certain groups. The number of daily feedings may be particularly important when investigating the effects of breastfeeding on the maternal bond, because the hormones that in theory may be beneficial are affected by both feeding behavior and frequency. OT concentrations may be sufficiently elevated to affect the maternal bond only in mothers who feed frequently. Supporting this suggestion, basal OT levels were found not to differ between breastfeeding and non-breastfeeding mothers (Levine et al., 2007; van der Post et al., 1997).

Thus, modern human breastfeeding behavior may not affect the mother–infant relationship, since in western society we do not feed often enough to affect the maternal bond and not long enough to affect infant attachment. This means that before any conclusions can be reached on whether breastfeeding does or does not affect the mother–infant relationship, it will be necessary to carry out studies on sufficiently large (non-western) populations, taking both breastfeeding duration and frequency into account.

Additionally, careful consideration should be given to moderating and mediating factors. In contrast with non-western societies, in western society the decision to breastfeed has become a political issue that is affected by cultural perceptions, feelings of sexuality and integration, and conflict between being a mother and pursuing a career (some of these themes have been reviewed by Van Estrik, 2002), and thus decisions on infant feeding are likely to differ between social groups. Not all mothers choose to breastfeed their babies. Mothers who initiate breastfeeding differ from bottle-feeding mothers in age, socio-economic status, ethnicity, smoking status, maternal employment and attitudinal and intrapersonal characteristics (Dennis, 2002). Women least likely to breastfeed are younger, have a lower income and are likely to be from an ethnic minority. Furthermore, mothers deciding to bottle-feed do so most often because of mother-centered reasons, whereas breastfeeding mothers do so for baby-centered reasons (Arora et al., 2000; Wiesenfeld, Malatesta, Whitman, Granrose, & Uili, 1985), suggesting pre-feeding differences in maternal motivation. These moderators may mask potential effects of breastfeeding (Corter & Fleming, 2002), and, as can be seen in Table 1, may
compromise the validity of the results. Thus, studies should always compare breast- and bottle-feeding mothers controlling for maternal age, parity, education level, ethnicity (in multi-ethnic research populations), socio-economic status, and other possible confounders such as the presence or absence of other children.

As discussed before, an effect of breastfeeding on the mother–infant relationship need not be a direct effect, but may be mediated by other factors. Although they find no evidence in their sample, Britton et al. (2006) suggest that an effect of breastfeeding on infant attachment may be mediated by alterations in maternal sensitivity. Likewise, maternal mood may affect any mother–infant interaction and may thus have an effect on later infant attachment or the maternal bond. Accounting for these potential mediators of later attachment security may be beneficial for detecting a potential effect of breastfeeding on the mother–infant relationship.

The maternal bond

Research on the maternal bond suffers from a number of problems. First, the maternal bond has been poorly defined, and as a result, current research suffers from the negative associations with the bonding research that was carried out nearly 25 years ago. We propose to define the maternal bond as the tie from mother to infant that promotes maternal behaviors aimed at mother–infant proximity and caregiving.

Second, because the developmental course of the maternal bond is unclear, its development, or lack thereof, should be assessed throughout the infant's first years of life, preferably even starting during pregnancy, and with repeated measurements during the first year.

Finally, there has been no evaluation of instruments to assess the maternal bond. It has been measured by self-report questionnaires (Parental Stress Index in Else-Quest et al., 2003; Post-partum Bonding Questionnaire in Edhborg, Matthiesen, Lundh, & Widström, 2005; Maternal Attachment Inventory in Müller, 1994; Yale Inventory of Parental Thoughts and Action in Feldman et al., 1999) and with behavioral observations coded with qualitative rating scales (self-designed in Cernadas et al., 2003; Avant-tool in Martone & Nash, 1988). All these instruments are likely to assess different aspects of the maternal bond. As an example, questionnaires that have been developed for use in a clinical setting, such as the bonding scale of the Parental Stress Index (PSI: Abidin, 1986) or the Post-partum Bonding Instrument (PBI: Brockington et al., 2001), are designed toward diagnosing potential failure in maternal bond formation, but are unable to quantify the maternal bond beyond its presence or (if possible) absence. Likewise, the self-designed observational scale used by Cernadas et al. (2003) distinguishes between a ‘very good’, ‘good’, and ‘fair’ bond, based on the amount of baby-directed touching, holding and looking of the mother. The discriminating power of this scale appears to be low, however, as only 14 out of 529 mothers were characterized as bonded ‘fair’, the others falling into the ‘very good’ (n = 223) or ‘good’ (n = 302) category. Therefore, for any potential effect of breastfeeding on the maternal bond to be investigated, current methods should be compared and refined.

We also recommend the development of new research tools for assessing the maternal bond. While these new tools could be questionnaires, this area of research would greatly benefit from alternative methods to assess the maternal bond. Questionnaires often suffer from social desirability of the answers, and outcomes are likely to be confounded by maternal mood or psychopathology (Hornstein et al., 2006; Moehler, Brunner, Wiebel, Reck, & Resch, 2006). It should be noted, however, that when measuring the maternal bond through observation, various but specific components of the maternal bond should be invoked (e.g., ‘motherese’ vocalizations, maternal gaze, and touch; Levine et al., 2007), in an interaction comprised of various situations (e.g., infant present and absent, during free play and a structured task). In their study on breastfeeding and the maternal bond, Martone and Nash (1988) observed mother–infant pairs only during feeding and thus any difference in maternal caregiving behavior may reflect behavioral differences inherent to the situation, rather than differences in the maternal bond. One of the future goals of research on the maternal bond therefore will be to carefully theorize on various components of the maternal bond and how these may be measured, and to thereafter test these theories using standardized situations or procedures.

Experimental paradigms that assess subconscious associations, such as the startle response procedure (Spangler, Emlinger, Meinhardt, & Hamm, 2001) or the implicit association test (IAT: Greenwald,
McGhee, & Schwartz, 1998), could be ideally suited to quantify the motivational and emotional aspects of the maternal bond, because they circumvent issues such as social desirability or situation-specific differences during observations. Standardized mother–infant interactions, much like the strange situation procedure for measuring infant attachment, may allow measurement of quality and quantity of specific maternal behaviors.

**Infant attachment**

Whereas research on the maternal bond is hampered by a plethora of research tools that mostly lack applicability beyond a clinical setting, the Strange Situation Procedure and the Attachment Q-Sort have been widely accepted as the gold standards of attachment security assessment in a wide area of infant research.

However, the use of the widely applied “secure” versus “insecure” dichotomization that results from the Strange Situation Procedure may not be best for assessing infant attachment in studies where small effects are expected (such as when determining the effect of breastfeeding on infant attachment). Although these categorical scores have been successfully applied in numerous studies (e.g., predicting attachment from parental sensitivity, or predicting future development from attachment), the sensitivity of dichotomized scores is constrained because differences in attachment security between infants within categories are not taken into account; that is to say, infants classified as “secure” are all treated as equally secure. It is possible that the AQS, which yields continuous security scores, is more suitable for detecting (subtle) influences of breastfeeding on attachment security (see also Fraley and Spieker (2003) for further discussion on the use of a continuous versus categorical attachment score).

Furthermore, both the SSP and the AQS are aimed at assessing attachment security after a clear-cut attachment has been formed, and are therefore not applicable for assessing the quality of the developing attachment relationship during the first year of life. One could argue that attachment security is ‘in the making’ during the first year, and that the validity of early measures may be low, but studies correlating early infant visual attention with later attachment security (Grossman, Grossman, Spangler, Suess, & Unzner, 1985; Koulomzin et al., 2002) indicate that there are key behaviors that may predict later attachment. Measures to assess ‘attachment-in-the-making’ in the first year of life might be very useful in studying the effect of breastfeeding on the developing infant–mother attachment relationship. An interesting candidate might be the Induced Stress at Home (ISH) procedure, developed by Hoeksma, Koomen, and Van den Boom (1996). Hoeksma et al. used the ISH procedure to longitudinally study the development of the attachment behavioral system in a group of infants between 3 and 12 months of age. Approximately one week after the last ISH procedure, the infants and their mothers were also subjected to the Strange Situation Procedure. The ISH was shown to be a valid measure to induce and measure the attachment behaviors proximity seeking, contact maintaining, and avoidance. The ISH procedure might therefore be an interesting procedure for studies examining the effects of breastfeeding on infant–mother attachment.

**Conclusion**

The scientific research carried out to date does not support the general assumption that breastfeeding has a positive effect on the quality of the mother–child relationship. When propagated, such an assumption may create unnecessary feelings of guilt in mothers unable to breastfeed. Recommendation of breastfeeding should therefore solely be based on its well-documented positive effects on infant and maternal health.

**References**


