

Breastfeeding, Bonding, and the Mother-Infant Relationship

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Mothers often report that breastfeeding is an enjoyable and emotionally beneficial experience they share with their infants. However, little research has investigated the role of feeding method in the development of the maternal bond and the mother-infant relationship. This study tested two hypotheses—the bonding hypothesis and the good-enough caregiver hypothesis—regarding the association of breastfeeding with maternal bonding and the mother-infant relationship. Using data from a longitudinal study of 570 mother-infant pairs, bonding and the quality of the mother-infant relationship were measured at 4 and 12 months. Although breastfeeding dyads tended to show higher quality relationships at 12 months, bottlefeeding dyads did not display poor quality or precarious relationships. Such results are encouraging for nonmaternal caregivers and mothers who bottlefeed their children.

Researchers have become increasingly interested in the physiological and immunological aspects of breast milk while largely ignoring the psychological experience of breastfeeding. Although nursing

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This research was supported by National Institute of Mental Health Grant MH44340 to Janet Hyde and Marilyn Essex, with Roseanne Clark and Marjorie Klein. Additional funding was provided by the University of Wisconsin Graduate School, the Wisconsin Psychiatric Research Institute, the John D. and Catherine T. MacArthur Foundation Research Network on Depression (David J. Kupfer, Chair), and the Wisconsin Center for Affective Science (NIMH P50-MH53254; Richard J. Davidson, Director). Special thanks are extended to project staff, including Jeff Armstrong; to the videotape raters, Peggy Burke, Terrie Kriesler, Amy Platten, Michelle Safran, and Lisa Spierer; and to Lyn Abramson, Charles Snowdon, and Hill Goldsmith for helpful comments on an earlier draft.

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Merrill-Palmer Quarterly, October 2003, Vol. 49, No. 4, pp. 495–517. Copyright © 2003 by Wayne State University Press, Detroit MI, 48201.

mothers report that feedings furnish not only nutritional but also social and psychological nourishment for them and their infants (Newton, 1971; Newton & Newton, 1967; Wiesenfeld, Malatesta, Whitman, Granrose, & Uili, 1985), the possible link of breastfeeding to the development of maternal bonding and the mother-infant relationship has received little research. The present study addresses the role of breastfeeding compared with bottlefeeding in the development of the maternal bond and the relationship of the mother-infant dyad. Two alternative theoretical models frame the research: the bonding hypothesis and the good-enough caregiving hypothesis.

Following Kennell and Klaus (1998), the term *bond* refers to the emotional connection of the mother to her infant. The function of bonding behaviors is to maintain proximity of the mother to her infant (Maestripieri, 2001a). Originally, bonding theorists argued that, for an optimal bond to develop, physical contact between the mother and infant must occur early in the postpartum period (Klaus et al., 1972). It is at this particular time when maternal oxytocin circulation (as a component of labor) is at its peak, and some research has shown that at times when central oxytocin levels are high in women, they are predisposed to form bonds and display affiliative behavior (Carter, 1998; Klaus, 1998; Kennell & Klaus, 1998). Numerous studies in nonhuman animals have shown that maternal behavior can be mediated by the peptide hormone (Kendrick, Keverne, & Baldwin, 1987; Maestripieri, 2001a; Pedersen, Ascher, Monroe, & Prange, 1982), yet these findings have not been replicated consistently in human mothers (see Eyer, 1992; Lamb, 1983, for reviews).

The few behavioral studies done on breastfeeding mothers provide suggestive results. One study showed that mothers who breastfeed tend to be more responsive to their infants (Wiesenfeld et al., 1985). Breastfeeding mothers also tend to touch their infants more during both feedings and playtime (Bernal & Richards, 1970; Kuzela, Stifter, & Worobey, 1990). Finally, other research has shown that breastfeeding mother-infant dyads spend significantly more time in mutual gaze during feedings than do bottlefeeding dyads (Lavelli & Poli, 1998). These findings indicate that breastfeeding may be associated with the maternal bonding process.

Other suggestive findings on the mother's experience of breastfeeding are provided by Mezzacappa and Katkin (2002). They experimentally assigned breastfeeding mothers to bottlefeed for one feeding and breastfeed for another. Maternal positive and negative affect were measured before and after feedings. Breastfeeding decreased mothers' negative affect, whereas bottlefeeding decreased their positive affect.

Mezzacappa and Katkin argued that breastfeeding can buffer the effects of stress—but not elevate mood—and that these effects are mediated by maternal oxytocin. Might these changes in affect facilitate the bonding process?

The bonding hypothesis suggests that the development of the maternal bond may go astray if certain important experiences during the first few hours or days postpartum fail to occur. This reductionist view is not without criticism, however. Although Klaus et al. (1972, p. 460) claimed that lack of early postpartum contact could “adversely affect maternal performance in some women” and reported that early contact might prevent maternal abandonment (see Kennell & Klaus, 1998), critics of bonding theory note that slight variations in postpartum contact do not appear to produce lasting differences in the mother-infant relationship (Lamb, 1983; Maestripieri, 2001a). In addition, critics have claimed that the observed differences have tended to be in women at risk for displaying poor quality maternal care (Eyer, 1992).

Much of the bonding research began with Klopfer’s (1971) observation that many animals display a sensitive period in the early postpartum for the development of a maternal bond. Lamb (1983) pointed out, however, that these findings hold mostly for ungulates and some rodents but rarely for primates. Additionally, some critics have argued that human bonding is too durable and multifactored a system to rely on the presence of hormones during a sensitive period. Lamb asserted “It is unlikely that so complex and plastic a behavior as human parenting would be narrowly and critically dependent on hormonal triggers and preorganized behavior patterns” (1983, p. 489). Kennell and Klaus (1984) eventually revised their bonding theory in response to the abundance of studies that failed to replicate their original 1972 findings (Eyer, 1992). They acknowledged that bonding does not *require* skin-to-skin contact in the early postpartum but could be facilitated by it. If such contact is not necessary for adequate bonding, it follows that breastfeeding may be neither necessary nor sufficient to foster the development of a maternal bond or appropriate maternal behavior.

If breastfeeding does foster the development of the maternal bond, what possible processes may mediate this relationship? The physiological processes that are theorized to account for bonding might operate during breastfeeding in that the nipple stimulation the infant provides when sucking triggers an oxytocin surge in the mother. This is a component of the milk letdown reflex, which results in the expression of breast milk. In humans, peripheral oxytocin secretion is usually associated with increased parasympathetic activation (e.g., increased vagal

nerve tone and decreased blood pressure and heart rate; Uvnäs-Moberg, 1997). Moreover, the central administration of oxytocin in rats, prairie voles, monkeys, and sheep appears to have anxiolytic and sedative effects (for a review, see Taylor et al., 2000). If maternal oxytocin increases parasympathetic activity and decreases anxiety, enhanced bonding may result. Further, if a mother feels a stronger bond to her infant, she may become a more responsive and sensitive caregiver and a higher quality mother-infant relationship may ensue.

In addition, breastfeeding necessarily provides increased skin-to-skin contact for the mother-infant dyad when the infant's face touches the mother's breast. Skin-to-skin contact can improve affect and reduce anxiety (Field et al., 1999; Field et al. 1997; Turner, Altemus, Enos, Cooper, & McGuiness, 1999). When mothers hold their nude infants against their chests in direct skin-to-skin contact, increases in maternal responsiveness and bonding are observed (Anderson, 1995; Cleary, Spinner, Gibson, & Greenspan, 1997; Klaus, Kennell, & Klaus, 1995; Tessier et al. 1998). Uvnäs-Moberg (1997) contended that skin-to-skin contact might elicit such effects via elevated oxytocin levels in the caregiver's plasma and cerebrospinal fluid. This contact is similar to that seen during breastfeedings in that, although the infant is likely clothed, it remains in close contact with the mother's trunk. Therefore, given the increased oxytocin circulation as a component of the milk letdown reflex and skin-to-skin contact, breastfeeding may play a role in the development of maternal bonding and improve the quality of the mother-infant relationship. Although not the focus of the current research, oxytocin (as a component of the milk letdown) and skin-to-skin contact are potential mediating processes in the study of breastfeeding and maternal bonding.

Given these potential mediating processes, might breastfeeding alter the development of the mother-infant relationship? Belsky's (1984) process model of parenting theorizes that any threats to the reliability of the parenting process are likely to be buffered by strengths in other aspects of parenting. For example, a bottlefeeding mother may be otherwise very sensitive and responsive to her infant's needs. Moreover, maternal care is a complex set of behaviors and attitudes and is robust enough to endure deviations from its original or natural form. Belsky contended, "Because parental functioning is multiply determined by factors emanating from within the parent, within the child, and within the family and social context in which the mother-child relationship is embedded, it stands to reason that no single factor will exert a uniform effect on parenting" (Belsky, Rosenberger, & Crnic, 1995, p. 121).

If the maternal care system is robust to variation, it follows that mothers need not provide ideal care, but rather *good-enough* care. Good-enough care refers to maternal care that is, although perhaps imperfect, adequate for the normal development of the infant and the mother-infant relationship. Despite cultural prejudice, nonmaternal care does not predict poor quality mother-infant relationships (Erel, Oberman, & Yirmiya, 2000; National Institute of Child Health and Human Development Early Child Care Research Network, 2000; Scarr, 1984; Scarr, Phillips, & McCartney, 1989). If nonmaternal care is good enough, care from bottlefeeding mothers is likely good enough as well. The good-enough caregiving hypothesis contends that breastfeeding is neither a necessary nor a sufficient condition for the development of a high quality mother-infant relationship.

The purpose of this research was to investigate the role of early breastfeeding, compared with bottlefeeding, in the development of maternal bonding and the mother-infant relationship. Are breastfeeding mothers more likely to develop stronger bonds to their infants? The bonding hypothesis predicts that breastfeeding mothers should display stronger bonds to their infants. Because the maternal bond can potentially influence the development of the mother-infant relationship, do breastfeeding dyads have higher quality relationships? The good-enough caregiving hypothesis predicts that there should be no differences in the mother-infant relationship as a function of feeding method in the early postpartum because the maternal care system is robust.

Method

Participants

A sample of 570 pregnant women participating in a longitudinal study, the Wisconsin Maternity Leave and Health (WMLH) Project, were studied. Participants in their 2nd trimester of pregnancy were recruited through several obstetrics and hospital clinics in the Milwaukee and Madison, Wisconsin, metropolitan areas. The mean age of the mothers at the time of recruitment was 29, ranging from 20 to 43 years. Ninety-three percent of the mothers were of white, not Hispanic, origin (for details regarding the sample, see Clark, Hyde, Essex, & Klein, 1997; Hyde, Klein, Essex, & Clark, 1995).

In order to be eligible for participation in the WMLH Project, women needed to meet these criteria: (a) over the age of 18; (b) between weeks 12 and 21 of pregnancy; (c) not disabled in a way that would alter physical functioning as a parent; (d) living with the partner, though not necessarily married; (e) at least one member of the couple

working for pay or profit; (f) not a student; (g) not self-reported as "unemployed;" (h) have a telephone in order to set up appointments for interviews; (i) speak English well enough to understand the interviewer; and (j) be sufficiently literate to complete paper-and-pencil questionnaires. Of the women who were eligible to participate, 75% did so.

Procedures and Measures

During the 2nd trimester of pregnancy and 4 and 12 months postpartum, mothers completed a home interview and responded to a mail-out questionnaire. A subset of 381 and 359 mother-infant dyads participated in the Parent-Child Early Relational Assessment (PCERA) at 4 and 12 months, respectively.

Feeding Practices. During interviews at 4 and 12 months postpartum, mothers answered questions regarding infant feeding practices; in particular, whether they had attempted breastfeeding and, if so, for how long they breastfed. In the current study, breastfeeding mothers were distinguished from bottlefeeding mothers by having breastfed during the first week because bonding is theorized to occur during the very early postpartum period (Klaus et al., 1972). Bottlefeeders were those mothers who had never breastfed their infants.

Possible Preexisting Group Differences. Feeding method can be associated with a mother's socioeconomic status (SES), age, ethnicity, and educational level (DiPietro, Larson, & Porges, 1987; While, 1989). Feeding methods may also reflect personality, parenting styles, or values (Newton, 1971). The implication of such patterns is that any differences that may be seen in the mother-infant relationship in breastfeeding versus bottlefeeding mothers may not necessarily be due to feeding method but rather to preexisting differences in such psychological constructs. We measured several variables that might identify preexisting (i.e., prebirth) differences between breastfeeding and bottlefeeding mothers.

Relevant personality dimensions include nurturance, neuroticism, anxiety, and anger, which were assessed during pregnancy. The Jackson Personality Research Form scale for nurturance measured the degree and quality of interpersonal orientation (Jackson, 1989). There are 16 items on the nurturance scale; a sample item is "I often take young people under my wing." Mothers answered either true or false to the items. Higher scores indicate a more nurturing personality. Jackson (1989) computed test-retest reliability, $r = .95$.

Neuroticism, a personality dimension that reflects emotional lability and reactivity, was measured using Eysenck's Personality Inventory

(EPI; Eysenck, 1960). Mothers answered true or false to items in terms of their "usual way of acting and feeling." A sample item is "Are your feelings rather easily hurt?" Higher scores indicate greater neuroticism. Test-retest reliability is high, $r = .86$.

The Spielberger State-Trait Anxiety Inventory (Spielberger, 1983) and the Spielberger State-Trait Anger Expression Inventory (Spielberger, Jacobs, Russell, & Crane, 1988) assessed state anxiety and state anger, respectively. Anxiety and anger alternate in the 20-item scale and are rated on a scale from 1 (*not at all*) to 4 (*very much*) regarding how participants felt in the past week. High scores indicate high levels of anxiety and high levels of anger. A sample item for anxiety is "I was tense," and a sample item for anger is "I was furious." Spielberger (1983) computed reliability for anxiety ($\alpha = .93$) and anger ($\alpha = .93$).

In order to assess the amount of negative affect mothers felt in a typical week during the 6 months prior to pregnancy, we used the Center for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977). Mothers rated each of 20 items on an anchored scale of frequency ranging from 0 (*rarely or none of the time*) to 3 (*most or all of the time*). The overall score was calculated by summing the ratings over 20 items, so the possible range of scores is 0 to 60. Higher numbers indicate more negative affect and symptoms of depression. A cutoff of 16 or above is generally used to indicate "caseness." Internal consistency on the CES-D is high in samples from the general population, $\alpha = .85$ (Radloff, 1977). Test-retest reliability is moderate and ranges from $r = .51$ to $r = .67$ (Radloff, 1977).

Additionally, the degree to which a woman may identify with traditional gender roles was suspected to relate to her breastfeeding decision. Thus, we measured attitudes about gender roles with the Traditional-Egalitarian Sex Role scale (TESR; Larsen & Long, 1988). Mothers rated on a scale from 1 (*strongly agree*) to 5 (*strongly disagree*) 20 items, such as "Ultimately a woman should submit to her husband's decision." Hyde and McKinley (1993) computed reliability in the current sample during the 2nd trimester of pregnancy, $\alpha = .84$.

Feeding methods may relate to other factors in the family, such as the relationship a mother has with her partner or husband and the degree of family salience. The partner-role quality scale (Barnett & Marshall, 1989) was used as a measure of the quality of the marital relationship during pregnancy and measured both positive (rewards) and negative (concerns) aspects of the marital relationship prior to the child's birth. The rewards scale consisted of 19 items, such as "When you think about your relationship right now, how rewarding is it because your partner appreciates you?" The concerns scale consisted of

22 items, such as "When you think about your relationship right now, how concerned are you because your partner does not understand who you really are?" All items were rated on a scale ranging from 1 (*not at all*) to 4 (*extremely*). Barnett and Marshall (1989) obtained a reliability coefficient of $\alpha = .93$ for the reward scale and $\alpha = .88$ for the concern scale. The test-retest reliability was $r = .87$ for the reward scale and $r = .78$ for the concern scale at a 1- to 3-month interval.

To measure commitment to family and the participation and value expectations women have regarding the family role, the family salience scale from the Salience Inventory (Nevill & Super, 1986) was used. Each of the 10 items is rated on a scale from 1 (*little or none*) to 4 (*a great deal*). Scores are summed such that high scores indicate high salience and commitment. A sample item is "I am very much involved in home and family activities." Nevill and Super (1986) computed a test-retest reliability of $r = .69$.

Parent-Child Early Relational Assessment. In order to measure the quality of the mother-infant relationship, the Parent-Child Early Relational Assessment (Clark, 1999; Clark, Hyde, Essex, & Klein, 1997) was administered at 4 and 12 months postpartum. The PCERA aims to "capture the infant/child's experience of the parent, the parent's experience of the child, the affective and behavioral characteristics that each bring to the interaction, and the quality or tone of the relationship" (Clark, 1985, p. 2). As noted earlier, subsets of the 541 families participated in the PCERA; financial constraints prevented researchers from collecting this measure with the remaining families.

Mother-infant dyads were videotaped in their homes for three 5-minute sessions. The sessions included a feeding (dyads bottlefed or breastfed at 4 months according to their typical practice and fed solid food at 12 months), a structured task (diapering at 4 months and reading a book at 12 months), and a free play. Each of the three sessions of the PCERA was coded for 65 items that were rated on a 5-point scale by experienced and trained raters. The items comprise six and eight scales at 4 and 12 months, respectively. Higher scores indicate higher quality interactions. Scores of 1 to 2 indicate an area of concern, 3 an area of some concern, and 4 to 5 an area of strength (Clark, 1999). At the 4-month assessment, financial constraints precluded coding of the structured task; thus, data are only available for the feeding and play tasks.

At 4 months, those variables comprise six scales. The parental positive affective involvement, sensitivity, and responsiveness scale is comprised of 16 items, including enthusiastic mood, visual contact, social

initiative, and quality of verbalizations. The parental negative affect and behavior scale is comprised of 13 items, including angry, hostile mood, negative physical contact, intrusiveness, and rigidity. The infant positive affect, communicative, and social skills scale contains 11 items, including alertness, exploratory play, expressed positive affect, and visual contact. The infant dysregulation and irritability scale contains eight items, including anxiety, emotional lability, self-regulation and organization, as well as consolability and soothability. The dyadic mutuality and reciprocity scale is comprised of three items, including enthusiasm and reciprocity. The dyadic tension scale has five items, including joint attention and activity, as well as state dissimilarity.

Clark (1999) computed internal consistency for each of the scales in the current sample at 4 months: parental positive affective involvement, sensitivity, and responsiveness ($\alpha = .94$); parental negative affect and behavior ($\alpha = .86$); infant positive affect, communicative, and social skills ($\alpha = .88$); infant dysregulation and irritability ($\alpha = .91$); dyadic mutuality and reciprocity ($\alpha = .85$); and dyadic tension ($\alpha = .87$).

At 12 months, the 65 variables comprise the following eight scales (Clark's [1999] reports of internal consistency follow in parentheses). The parental positive affective involvement and verbalization scale is comprised of 11 items, including expressed positive affect, visual contact, social initiative, and quality of verbalizations ($\alpha = .91$). The parental negative affect and behavior scale is comprised of five items, including angry, hostile mood, expressed negative affect, and displeasure ($\alpha = .91$). The parental intrusiveness, insensitivity, and inconsistency scale is comprised of eight items, including anxious mood, lack of structuring, rigidity, and intrusiveness ($\alpha = .86$). The infant positive affect, communicative, and social skills scale contains eight items, including expressed positive affect, social initiative, and visual contact ($\alpha = .87$). The infant quality of play, interest, and attentional skills scale is comprised of 10 items, including alertness/interest, persistence, and readability ($\alpha = .87$). The infant dysregulation and irritability scale contains six items, including aggressivity, emotional lability, self-regulation and organization, as well as impulsivity ($\alpha = .83$). The dyadic mutuality and reciprocity scale is comprised of four items, including enthusiasm and reciprocity ($\alpha = .87$). The dyadic disorganization and tension scale has five items, including joint attention and activity, as well as state dissimilarity ($\alpha = .78$). As at 4 months, higher scores always indicate higher quality interactions. Intercorrelations among all eight scales are shown in Table 1.

Parenting Stress Index. The mother's mail-out questionnaire at 4 months included the Parenting Stress Index (PSI; Abidin, 1986). The

Table 1. Intercorrelations Among 12-Month PCERA Feeding Task Scales ($N = 352$)

Scale	1.	2.	3.	4.	5.	6.	7.	8.
1. Parental positive affective involvement								
2. Parental negative affect & behavior	.36**							
3. Parental intrusiveness	.76**	.60**						
4. Infant positive affect	.50**	.05	.33**					
5. Infant quality of play	.40**	.04	.35**	.76**				
6. Infant dysregulation & irritability	.23**	.31**	.39**	.24**	.45**			
7. Dyadic mutuality & reciprocity	.73**	.21**	.52**	.78**	.59**	.23**		
8. Dyadic disorganization & tension	.52**	.54**	.70**	.44**	.50**	.63**	.55**	

* $p < .05$, ** $p < .01$.

PSI is designed to yield a measure of the relative amount of stress in a mother-infant dyad and to identify the source of that stress. Two scales from the total PSI were included in the current study. These scales included the mother's attachment to the infant and her sense of reinforcement by the infant. Items were rated on a 5-point scale, with higher scores indicating more stress in that domain.

With five items, the maternal attachment scale gauges the mother's emotional intimacy with the child and the ability to understand the child's feelings and needs. A sample item is "I expected to have closer and warmer feelings for my child than I do and this bothers me." Abidin (1986) computed internal consistency for the maternal attachment scale, $\alpha = .55$. For this sample, internal consistency was $\alpha = .56$. Because higher scores indicate more stress, lower scores indicate more positive attachment.

The infant reinforces parent scale is comprised of five items and measures the degree to which the mother feels reinforced by the infant. A sample item from this scale is "When I do things for my child I get the feeling that my efforts are not appreciated very much." Abidin (1986) reported internal consistency, $\alpha = .70$. For this sample, $\alpha = .70$.

Results

Descriptive Statistics

Overall, 77% ($n = 439$) of the mothers in the sample breastfed their infants during the first week, 16.5% ($n = 94$) never attempted breastfeeding, and 6.5% ($n = 37$) did not respond to breastfeeding questions. This last group was excluded from further analyses. Sixteen percent of breastfeeding mothers breastfed for 1 month or less, 50% of the breastfeeding mothers weaned their infants by 4 months, and 34% breastfed beyond 4 months. By the 1st birthday, 86% of breastfed infants had been weaned.

Possible Preexisting Group Differences. The following analyses tested for possible preexisting differences between breastfeeders and bottlefeeders. In these analyses, breastfeeders were defined as women who had breastfed their infants during the first week; bottlefeeders were defined as mothers who had never breastfed their infants. One-way ANOVAs were used to analyze the possible differences between breastfeeding and bottlefeeding groups on the measures of household income, age, ethnicity, educational level, nurturing personality, and partner role quality. Means, standard deviations, F values, and effect sizes (Cohen's d ; Cohen, 1977) for these analyses are shown in Table 2. The two groups did not differ significantly ($p > .05$) in age, family income, anxiety, anger, neuroticism, family salience, sex role attitudes, partner

Table 2. Means (Standard Deviations) *F* Statistics, and Effect Sizes of Pre-birth Maternal Variables in Breastfeeders and Bottlefeeders

<i>Maternal variable</i>	<i>Breast</i>	<i>Bottle</i>	<i>F</i>	<i>d</i>
	(<i>n</i> = 432-439) M (SD)	(<i>n</i> = 92-94) M (SD)		
Education	15.20 (2.12)	14.00 (2.01)	25.36**	.58
Age	29.51 (4.28)	28.57 (4.42)	3.62	.22
Income	8.24 (1.53)	8.21 (1.46)	0.04	.02
Anxiety	18.97 (5.02)	19.94 (5.69)	2.71	-.18
Anger	3.93 (.65)	4.02 (.61)	1.64	-.14
Neuroticism	9.05 (4.71)	10.05 (4.50)	3.50	-.22
Nurturance	11.49 (2.34)	12.33 (2.26)	9.85**	-.37
Family salience	35.68 (4.54)	35.06 (4.90)	1.40	.13
Sex role orientation	87.02 (10.33)	84.97 (8.65)	3.21	.22
Past depression	2.32 (1.37)	2.63 (1.48)	3.78*	-.22
Partner rewards	3.15 (.51)	3.16 (.57)	0.05	-.02
Partner concerns	1.43 (.40)	1.39 (.41)	0.72	.10

* $p < .05$, ** $p < .01$.

Note. Breastfeeding mothers are those who breastfed for at least 1 week and bottlefeeding mothers are those who never breastfed. Sample size varies according to missing data.

rewards, or partner concerns. The group difference for level of education was significant; results showed that breastfeeding mothers were more educated. The groups differed on the measure of nurturance such that, surprisingly, mothers with a less nurturing personality were more likely to breastfeed. They also differed on negative affect in that bottlefeeders had been slightly more depressed than breastfeeders in the 6 months preceding pregnancy. We considered effect sizes greater than $d = .25$ to be large enough for use as covariates. Thus, nurturance and education were used as covariates in analyses that follow, comparing breastfeeding and bottlefeeding dyads.

We also tested for possible pre-existing differences between breastfeeding and bottlefeeding groups in categorical variables: ethnicity (White vs. non-White), parity (multiparous vs. primiparous), and desire for pregnancy (wanting versus not wanting the pregnancy), using 2×2 chi-square analyses. The mother's ethnicity was not associated with whether she breastfed, $\chi^2(1, N = 533) = .29, p > .05$, nor was parity, $\chi^2(1, N = 533) = 3.49, p = .06$. In addition, whether the mother wanted the pregnancy was not related to breastfeeding choice, $\chi^2(1, N = 533) = 1.38, p > .05$.

Maternal Bonding

Because Klaus et al. (1972; Kennell & Klaus, 1998) argued that maternal bonding occurs in the very early postpartum period, breastfeeding during the first week should result in greater maternal attachment and sense of infant reinforcement. This association was measured at both 4 and 12 months.

Four Months. In order to test these hypotheses, a one-way between subjects MANCOVA assessed group differences in mother's reports of attachment and infant reinforcement (PSI scales) between breastfeeding and bottlefeeding mothers. Education and nurturance served as covariates. At 4 months, the overall multivariate statistic was significant using Pillai's Trace Criterion, $F(2, 476) = 4.01, p = .02$. The univariate test statistic assessing group differences on maternal attachment was marginally significant, $F(1, 495) = 3.07, p = .08$, such that breastfeeders tended to feel greater attachment to their infants ($M = 10.94, SD = 2.61$) than bottlefeeders did ($M = 11.36, SD = 2.74$) (lower scores indicate more attachment). In addition, the univariate test for group differences on infant reinforcement was significant, $F(1, 495) = 7.93, p = .01$, such that breastfeeders felt more reinforced by their infants ($M = 7.60, SD = 1.97$) than bottlefeeders did ($M = 8.14, SD = 2.27$). These results from 4 months support the bonding hypothesis that breastfeeding mothers have increased attachment and sense of reinforcement by their infants than bottlefeeding mothers do.

Twelve Months. At 12 months, a one-way between-subjects MANCOVA assessed group differences in attachment and infant reinforcement scales between breastfeeding and bottlefeeding mothers. Education and nurturance served as covariates. The overall multivariate F statistic was nonsignificant, $F(2, 489) = .74, p > .05$. On attachment, breastfeeding mothers ($M = 10.53, SD = 2.68$) scored similarly to bottlefeeding mothers ($M = 10.82, SD = 2.91$). Regarding the sense of reinforcement from the child, breastfeeding mothers ($M = 7.96, SD = 2.20$) scored similarly to bottlefeeding mothers ($M = 8.18, SD = 2.35$) as well. Thus, the bonding hypothesis was not supported at 12 months.

Parent-Child Early Relational Assessment

The good-enough caregiver hypothesis predicted that there would be no group differences between breastfeeding and bottlefeeding dyads on the quality of the mother-infant relationship. Results are presented for 4- and 12-month data.

Four Months. In order to test these hypotheses, six one-way between-subjects MANCOVAs were run to assess group differences

between breastfeeding and bottlefeeding dyads on the six scales of the PCERA. Dependent variables were scores on the feeding and play tasks. Mother's education and nurturance served as covariates. First, the infant dysregulation scale (in both tasks) underwent a square root transform in order to reduce skewness. All means, standard deviations, and multivariate F statistics for 4-month data are shown in Table 3. The multivariate test statistic was not significant for any of the scales at 4 months. In sum, the data support the good-enough caregiver hypothesis.

Twelve Months. Six one-way between-subjects MANCOVAs assessing group differences between breastfeeding and bottlefeeding dyads on the eight scales of the PCERA were run. Dependent variables were scores on the feeding, structured, and play tasks. Mother's education and nurturance served as covariates. First, the infant dysregulation scale (in all three tasks) and the infant quality of play scale (in the feeding and structured tasks) underwent square root transforms in order to reduce skewness. All means, standard deviations, multivariate F statistics, and effect sizes for 12-month group comparisons are shown in Table 4. Three of the eight multivariate tests were significant, including parental negative affect; parental intrusiveness, insensitivity, and inconsistency; and infant dysregulation.

On the univariate tests for parental negative affect, group differences were significant on the structured task, $F(1, 330) = 6.32, p < .05$, and the feeding task, $F(1, 330) = 5.62, p < .05$, but not on the play task, $F(1, 330) = .74, p > .05$. Breastfeeding mothers scored higher on negative affect (indicating less negative affect) than bottlefeeding mothers did. On the univariate tests for parental intrusiveness, insensitivity, and inconsistency, group differences were significant on the structured task, $F(1, 333) = 4.45, p < .05$, and the feeding task, $F(1, 333) = 7.07, p < .01$, but not on the play task, $F(1, 333) = 2.07, p > .05$. Breastfeeding mothers scored higher on intrusiveness (indicating less intrusiveness) than bottlefeeding mothers did. On the univariate tests for infant dysregulation, the group differences between breastfed and bottlefed infants were significant on the structured task, $F(1, 333) = 6.19, p < .05$, and the feeding task, $F(1, 333) = 3.28, p < .01$, but not on the play task, $F(1, 333) = .31, p > .05$. Breastfed infants scored higher on infant dysregulation (indicating less dysregulation) than bottlefed infants.

The results from these MANCOVAs provide mixed support for the good-enough caregiving hypothesis in that, although breastfeeding dyads always scored more positively than bottlefeeding dyads, these differences were not consistently significant. In addition, none of the

Table 3. Scale Means, Standard Deviations, and Multivariate *F* Statistics of PCERA Scales in Breastfeeding ($n = 303$) and Bottlefeeding ($n = 59$) Dyads at 4 Months

Scale	F	Task	Breast		Bottle	
			M (SD)	M (SD)	M (SD)	M (SD)
Parental positive affective involvement & responsiveness	$F(2, 357) = .51, p > .05$	Feeding	3.45 (.71)	3.46 (.76)		
		Play	3.86 (.57)	3.73 (.67)		
Parental negative affect	$F(2, 357) = 1.13, p > .05$	Feeding	3.80 (.50)	3.67 (.55)		
		Play	4.27 (.46)	4.17 (.53)		
Infant organization, communication, & social skills	$F(2, 357) = 1.50, p > .05$	Feeding	3.48 (.60)	3.30 (.70)		
		Play	3.64 (.61)	3.56 (.62)		
Infant dysregulation & negative affect	$F(2, 357) = 1.24, p > .05$	Feeding	1.33 (.41)	1.26 (.47)		
		Play	1.35 (.37)	1.30 (.32)		
Dyadic mutuality & reciprocity	$F(2, 357) = .41, p > .05$	Feeding	2.98 (.82)	2.92 (.86)		
		Play	3.22 (.76)	3.05 (.86)		
Dyadic tension	$F(2, 357) = .98, p > .05$	Feeding	4.23 (.60)	4.12 (.70)		
		Play	4.20 (.54)	4.08 (.51)		

Note: Breastfeeding mothers are those who breastfed for at least 1 week and bottlefeeding mothers are those who never breastfed. Infant dysregulation and negative affect scales underwent square root transforms in order to reduce skewness.

Table 4. Scale Means, Standard Deviations, Multivariate *F* Statistics, and Effect Sizes of PCERA Scales in Breastfeeding ($n = 280-284$) and Bottlefeeding ($n = 52-53$) Dyads at 12 Months

Scale	F	Task	Breast		Bottle		d
			M (SD)	M (SD)	M (SD)	M (SD)	
Parental positive affective involvement & verbalization	$F(3, 326) = 2.10, p > .05$	Play	3.57 (.66)	3.32 (.69)		.36	
		Structure	3.77 (.48)	3.59 (.48)		.40	
		Feeding	3.67 (.64)	3.45 (.68)		.33	
Parental negative affect & behavior	$F(3, 326) = 3.14, p < .05$	Play	4.33 (.61)	4.21 (.63)		.20	
		Structure	4.26 (.56)	4.01 (.37)		.53	
		Feeding	4.15 (.67)	3.82 (.80)		.45	
Parental intrusiveness, insensitivity, & inconsistency	$F(3, 326) = 3.05, p < .05$	Play	3.83 (.61)	3.69 (.60)		.24	
		Structure	4.23 (.40)	4.07 (.37)		.40	
		Feeding	4.08 (.55)	3.81 (.62)		.42	
Infant positive affect, communicative, & social skills	$F(3, 326) = .80, p > .05$	Play	3.30 (.68)	3.26 (.67)		.06	
		Structure	3.67 (.53)	3.57 (.45)		.19	
		Feeding	3.74 (.62)	3.75 (.63)		-.01	
Infant quality of play, interest, & attentional skills	$F(3, 326) = 1.43, p > .05$	Play	4.11 (.60)	4.04 (.59)		.11	
		Structure	2.99 (.69)	2.81 (.72)		.26	
		Feeding	3.03 (.72)	2.88 (.76)		.20	

Table 4. Scale Means, Standard Deviations, Multivariate *F* Statistics, and Effect Sizes of PCERA Scales in Breastfeeding ($n = 280-284$) and Bottlefeeding ($n = 52-53$) Dyads at 12 Months

Scale	F	Task	Breast		Bottle		d
			M	(SD)	M	(SD)	
Infant dysregulation & irritability	$F(3, 326) = 3.28, p < .05$	Play	3.15	(.68)	3.21	(.67)	-.09
		Structure	3.07	(.73)	2.83	(.66)	.35
		Feeding	3.22	(.84)	2.94	(.97)	.31
Dyadic mutuality & reciprocity	$F(3, 326) = 1.32, p > .05$	Play	3.25	(.77)	3.02	(.77)	.29
		Structure	3.53	(.56)	3.42	(.55)	.21
		Feeding	3.35	(.70)	3.25	(.72)	.13
Dyadic disorganization & tension	$F(3, 326) = .69, p > .05$	Play	4.17	(.54)	4.05	(.59)	.21
		Structure	4.14	(.41)	4.09	(.31)	.14
		Feeding	4.17	(.49)	4.06	(.53)	.20

bottlefeeding dyads' scores indicated an area of concern in the mother-infant relationship, reflecting good-enough maternal care.

Discussion

The results of the current study provide mixed support for the bonding hypothesis but sound support for the good-enough caregiver hypothesis. Breastfeeding mothers reported more attachment and infant reinforcement at 4 months but not at 12 months. The juxtaposition of these findings suggests that, if early breastfeeding has effects on maternal bonding, they are short-term ones. Mothers may benefit from breastfeeding by feeling stronger bonds in the early postpartum months, but such benefits are absent by the first birthday.

Conversely, breastfeeding dyads scored similarly to bottlefeeding ones on the PCERA scales at 4 months but scored better than bottlefeeding dyads at 12 months. Although breastfeeding was sometimes associated with better mother-infant relationship outcomes, the effect sizes were small to moderate. The group means for the PCERA scales are all well within the range of scores corresponding to good-quality relationships in that on very few scales did bottlefeeding dyads score less than 3.5 (prior to square root transforms; scores less than 3 indicate an area of concern). None of the group means suggest the need for intervention or special care. In sum, there is no reason to believe that mothers are harming the relationships they have with their children by bottlefeeding them.

Early breastfeeding was associated with less parental negative affect, parental intrusiveness, and infant dysregulation at 12 months, but there were no associated differences in maternal or infant positive affect. That breastfeeding is associated with lower levels of negative constructs but not higher levels of positive constructs is at first puzzling. Why should breastfeeding be associated with less negative affect but not more positive affect? Interestingly, this finding is consistent with the results of Mezzacappa and Katkin (2002), who found that breastfeeding acutely decreased negative affect but had no effect on positive affect. As they proposed, the process may be one that buffers the negative rather than enhances the positive.

It is surprising that early breastfeeding was associated with higher quality mother-infant interactions at 12 months but not at 4 months. One possibility is that this is a measurement artifact. At 4 months of age, the infant's motor capacity is very limited in scope: Subtle changes in mood or interaction quality are difficult to perceive. Although the

PCERA is a highly reliable and valid measurement tool, it may perform better at 12 months than at 4 months, given the infant's emotional and motor development. Generally, we should expect the "effects" of breastfeeding to be greater or more evident at an earlier age (when the dyad is likely to have breastfed recently) than at a later one (when they may not have breastfed in several months). For this reason, it is more reasonable to suspect measurement limitations as the source of this inconsistency in results.

The findings from the current study are sources of optimism for nonmaternal and nonbiological caregivers, such as fathers and adoptive parents. If bottlefeeding mothers can provide good-enough care, so can fathers and adoptive parents. Historically, maternal care has been perceived as necessarily best and irreplaceable (Scarr, 1984). However, in conjunction with research on nonmaternal care, the current study illustrates how quality care can come from various sources.

The process model of parenting would predict that the possible psychological benefits of breastfeeding might be more powerful in a family that is deficient in other resources or components of caregiving. The process model contends that, when one element of the parental care system is lacking, other elements may compensate to provide good-enough care (Belsky, 1984). Thus, when some aspects of caregiving are not good enough, breastfeeding may provide detectable benefits for the mother-infant relationship. Just as the health benefits of breastfeeding increase in countries with poor sanitation and nutrition (Eiger & Olds, 1999; Jason, Nieburg, & Marks, 1984; Small, 1998), the psychological benefits may be more noticeable in mothers with, say, low socioeconomic status or poor social support. In fact, bonding critics point out that Klaus et al.'s (1972) original findings on bonding were obtained with high-risk samples and that such results have not been replicated in low-risk ones (Eyer, 1992; Hrды, 1999; Lamb, 1983). Future research on breastfeeding and mother-infant psychosocial outcomes may focus on families that are at high risk for poor-quality mother-infant relationships. We ought to consider examining the questions of breastfeeding and the mother-infant relationship in samples in which the quality of the mother-infant relationship is more vulnerable.

It is not possible to randomly assign mothers to breastfeeding or bottlefeeding conditions. The current study design is not experimental and causal inferences are unwarranted. The decision of feeding method is a complex process for a mother and is not independent of her parenting styles or other psychosocial or economic factors. In the WMLH sample, education and nurturance were related to the decision

to breastfeed. Nonetheless, the fact that several differences were significant after controlling for these variables lends greater support to the argument that breastfeeding may be influential.

Bonding theory has generally maintained that the early postpartum is a sensitive—and not critical—period for the development of a maternal bond. Maestripieri (2001b) argued that the early postpartum period is characterized by an enhanced maternal motivation to provide infant care. Strictly speaking, a sensitive period does not imply that the behavior cannot occur or develop outside of the specified time frame. Clearly, bonding is a process that develops over time and is not necessarily triggered by oxytocin in the early postpartum. In addition, the current study does not rule out the possibility that bonding may occur in the context of breastfeeding. Rather, it suggests that bottle-feeding mothers develop adequate bonds to their infants by 12 months of age.

In a chapter on infant feeding, mother-infant interaction, and stress management, Carter contended “Breastfeeding, by the nature of the process, virtually guarantees appropriate mother-infant interactions,” (1988, p. 27). Such assertions are idealistic but unwarranted. The current data do not support the claim that breastfeeding dyads necessarily have higher quality relationships. Instead, they support the claim that bottlefeeding mothers can provide care that is good enough to maintain a high quality mother-infant relationship.

The current study reminds us that maternal care is a complex set of behaviors and attitudes, robust enough to persist and remain adequate despite minor deviations from its original or natural form. These findings are socially relevant for bottlefeeding mothers and nonmaternal caregivers, who may worry about or face criticism regarding their ability to develop high quality relationships with their children.

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