

# Breastfeeding, Sensitivity, and Attachment

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## ABSTRACT

**OBJECTIVE.** Our goal was to test the hypothesis that breastfeeding is associated with enhanced infant-mother attachment and its antecedent maternal sensitivity.

**METHODS.** Breastfeeding intent and practice were assessed by questionnaires administered to 152 mothers between 32 weeks of gestation and 12 months postpartum. Early maternal sensitivity was measured by the Sensitivity to Cues subscale of the Nursing Child Assessment Satellite Training Feeding Scale at 3 months, and quality of the mother-infant interaction was measured by the Nursing Child Assessment Satellite Training Feeding Scale at 6 months. Security of attachment was evaluated by the Ainsworth Strange Situation at 12 months.

**RESULTS.** A direct relationship between attachment security and breastfeeding practice was not identified. The quality of the mother-infant interaction at 6 months, rather than the type of feeding, predicted security of attachment. However, mothers who chose to breastfeed displayed greater sensitivity in dyadic interactions with their infants 3 months postnatally than those who chose to bottle feed, and intended breastfeeding duration prenatally correlated with sensitivity 3 months postpartum. Although a path analysis failed to demonstrate contributions of early breastfeeding duration to either sensitivity or security, it did substantiate a significant path between prenatal breastfeeding intent and attachment security mediated by sensitivity. In addition, multivariate analyses revealed that early sensitivity among breastfeeding mothers was an independent predictor of the duration of any and exclusive breastfeeding during the first year.

**CONCLUSIONS.** Although the quality of the dyadic interaction in infancy, rather than feeding type, is predictive of attachment security, mothers who choose to breastfeed display enhanced sensitivity during early infancy that, in turn, may foster secure attachment. Among breastfeeding mothers, higher sensitivity is associated with longer duration of breastfeeding during the first postpartum year. These findings suggest a link between attachment security and breastfeeding.

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### Key Words

breastfeeding, mother-infant attachment, maternal sensitivity

### Abbreviations

NCAST—Nursing Child Assessment

Satellite Training

ANOVA—analysis of variance

OR—odds ratio

CI—confidence interval

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**B**REASTFEEDING IS KNOWN to have positive effects on infant health and nutrition<sup>1</sup> and has been associated with enhancement of later cognitive ability and educational achievement.<sup>2-5</sup> It is also believed to foster the development of a “bond” between the mother and infant in early infancy.<sup>6-8</sup> In an early study,<sup>9</sup> mothers who nursed their infants during the first 3 hours after birth and then spent >15 hours with them over the next 3 days displayed greater emotional attraction to their infants 1 month later compared with mothers with minimal postpartum contact. The term “bonding” refers to the tie from parent to infant, a tie unique and specific to that relationship.<sup>6</sup> Although the effect of this bond is generally felt to be enduring,<sup>6</sup> an association between early bonding or breastfeeding experiences and the mother-child relationship later in infancy and early childhood remains to be established.<sup>10,11</sup>

The developing mother-child relationship in early childhood is characterized most frequently by the concept of attachment. Attachment was first described by Bowlby,<sup>12</sup> who theorized that infant behavior is adapted to complement caregiver behavior when the caregiver’s behavior is appropriate and responsive to the infant’s cues. In contrast to bonding, which refers to the parent’s emotional investment in the infant, the term “attachment” refers to the tie from infant to parent and is a representation of “the internal organization of the individual.”<sup>13</sup> A child with a mental representation of the parent as responsive and available is likely to be securely attached to the parent; insecure attachment occurs when such a representation is lacking. For the securely attached infant, the parent provides a secure base from which to explore the environment. Attachment security in late infancy seems unrelated to early maternal bonding experiences,<sup>10</sup> and unlike bonding its persistent effects throughout childhood have been demonstrated.<sup>14</sup>

A basic component of attachment theory is that infants gradually develop a relationship with a principal attachment figure and that the attachment figure’s sensitivity to the infant’s needs may be a critical factor for the establishment of a secure attachment.<sup>12</sup> Research over several decades, summarized in 2 meta-analyses,<sup>15,16</sup> has established that sensitivity is indeed an important but not exclusive predictor of secure attachment. The exact definition of sensitivity has varied widely in attachment research, yet promptness, consistency, and appropriateness are thought to be main constituents of this construct.<sup>17</sup> Some attachment authorities have argued that sensitivity permeates all interactive behavior and can only be studied as part of a dyadic unit,<sup>17</sup> and Bowlby<sup>18</sup> emphasized the importance of mutual satisfaction and enjoyment of the dyadic relationship in fostering attachment security.

Although Bowlby acknowledged that feeding may facilitate mother-infant proximity and thereby provide opportunity for sensitive interaction, his clinical obser-

ations led to predictions that neither feeding itself nor individual differences in feeding, such as breast or bottle, contribute to individual differences in attachment quality.<sup>19,20</sup> Attachment theory, thus, contrasts with the concept of bonding regarding the importance of breastfeeding: bonding is felt to be enhanced by breastfeeding, yet attachment is believed to be fostered by the quality of the dyadic interaction irrespective of feeding method. Given this contrast, it is surprising that although the relationship between breastfeeding and bonding has been explored,<sup>6-8</sup> no studies have been performed to assess the potential relationship between feeding type (breast or bottle) and infant-mother attachment.

Thus, the present study was designed to explore the potential relationships among breastfeeding, attachment, and sensitivity. We speculated that breastfeeding would be associated with enhanced infant-mother attachment and its antecedent maternal sensitivity and tested 5 related hypotheses. First, we hypothesized that mothers who decide to breastfeed would be more likely than those who do not to be sensitive parents to their infants in early infancy. Second, we postulated that breastfeeding dyads would be more likely to be securely attached in early childhood than those who do not breastfeed and that longer duration of breastfeeding would be associated with enhanced attachment security. Third, the hypothesis that the duration of breastfeeding in early infancy might foster secure attachment, either directly or through enhancement of maternal sensitivity, was tested. Fourth, we asked whether breastfeeding *per se*, or the quality of the dyadic interaction irrespective of feeding type, would be important predictors of attachment security. Finally, we speculated that breastfeeding mothers who are more sensitive to their infant’s cues would breastfeed their infants for longer periods than those who are less sensitive.

## METHODS

Participants were part of a prospective, nonrandomized, longitudinal cohort parenting study of 174 mother-infant dyads during the first year postnatally. The population has been described previously,<sup>21</sup> and the hypotheses of our study were formulated retrospectively using this database. Pregnant women were recruited for study participation by use of posters in waiting rooms and letters given at routine 32-week prenatal care visits. Recruitment sites included a freestanding birthing center, a large private obstetric group practice, university hospital obstetric and family practice clinics, and a neighborhood family health center. Approval of relevant institutional review boards and individual informed consent were obtained for all cases. Only mothers with singleton gestations expecting uncomplicated vaginal deliveries were enrolled. Cases were excluded if complications at the time of delivery required cesarean section, preterm delivery, or transfer of the newborn to a NICU.

Maternal social and demographic characteristics were determined from medical chart review and questionnaires administered at enrollment, before discharge from the place of delivery, and at 3, 6, 9, and 12 months postpartum. From these questionnaires, socioeconomic status was estimated by using the Hollingshead index (A. B. Hollingshead, PhD, *The Four-Factor Index of Social Status*, unpublished data, 1975). Social support from the father/spouse and the mother's family was assessed by using the Family Apgar.<sup>22</sup> On these instruments, higher scores reflect higher socioeconomic status and social support, respectively.

Questions also addressed intended or actual breastfeeding practices and duration. An extensive body of literature has demonstrated that most women who breastfeed decide to do so before delivery and that the duration of breastfeeding may be predicted by their intended duration prenatally.<sup>23–25</sup> Consequently, maternal intent to breastfeed or formula feed was determined from the prenatal questionnaire, and those mothers who intended to breastfeed were asked to estimate the expected duration of breastfeeding. In keeping with current breastfeeding research approaches,<sup>24,26</sup> actual lactation performance was measured by breastfeeding initiation and duration of breastfeeding among mothers who initiated breastfeeding. Mothers were deemed to have initiated breastfeeding if they began breastfeeding at the place of delivery and continued to do so at the time of discharge. Breastfeeding duration, coded as a continuous variable, was determined from feeding practices reported on the questionnaires at each time point throughout the study period. Consistent with current recommendations regarding definitions of breastfeeding,<sup>26</sup> mothers who were breastfeeding their infants fully without formula supplementation were characterized as exclusively breastfeeding, and those who breastfed partially or with any formula supplementation were denoted as practicing "any" breastfeeding. Infants who received only infant formula were considered to be bottle fed.

In addition to these parameters, several other breastfeeding variables were determined. Early breastfeeding was defined by dichotomous variables that designated any or exclusive breastfeeding at 3 months postpartum among mothers who initiated breastfeeding. Because the American Academy of Pediatrics has recommended any breastfeeding until at least 12 months postpartum and exclusive breastfeeding for the first 6 months,<sup>27</sup> additional dichotomous variables designated these outcomes. Finally, an ordinal variable coded early breastfeeding duration (0, none; 1, initiation only; 2, to 3 months or beyond).

The quality of the mother-infant interaction was measured at 6 months postpartum by the Nursing Child Assessment Satellite Training (NCAST) Feeding Scale.<sup>28,29</sup> Early maternal sensitivity was assessed by using the Sensitivity to Cues subscale of that instrument at 3

months postpartum. Although the NCAST Feeding Scale is administered during feeding, its assessment of the dyadic interaction is independent of feeding method. Feeding sessions were videotaped in the home and scored later by 2 raters who were trained and certified by developers of the scales. Interrater differences were reconciled by discussion and consensus with a third impartial certified rater. Because of the retrospective nature of the current study hypotheses, all raters were blind with respect to these hypotheses, especially any future relevance of feeding method (breastfeeding or bottle feeding) to data analysis.

Infant-mother attachment was assessed by the Ainsworth Strange Situation,<sup>30</sup> with laboratory sessions videotaped at 12 months postnatally and scored later by  $\geq 2$  trained raters. As with the NCAST, discrepancies among raters were reconciled by discussion and consensus, and all raters were blind with respect to study hypotheses. Dyads were categorized as securely attached, insecure-avoidant, insecure-resistant, or unclassified. It should be noted that the study was performed before the D category had been developed. For some analyses, dichotomous variables were used to indicate either secure or insecure attachment.

Statistical analyses included  $\chi^2$  analysis, Pearson correlations, *t* tests, and analysis of variance (ANOVA) with posthoc Scheffe tests for bivariate analyses and linear and logistic regression for multivariate analyses. Throughout the text, correlation coefficients are reported with sample size in brackets. Colinearity diagnostics were performed for linear regressions, and covariates were forcibly entered for all regression models. We used SPSS 11.5 (SPSS Inc, Chicago, IL) for analyses. Sample-size analysis was performed by using GPOWER.<sup>31</sup> For path analysis we used structural equation modeling with maximum-likelihood estimation performed with LISREL 8.3 (Scientific Software International, Lincolnwood, IL). Path coefficients are displayed diagrammatically for all proposed paths tested, with their magnitude indicative of the strength of the association. For all analyses, significance was accepted at  $P < .05$ .

## RESULTS

### Study Population

Study participants included 36 dyads from the freestanding birthing center, 59 from private obstetric group practice, 69 from university hospital obstetric and family practice clinics, and 10 from a neighborhood family health center. Although there was some attrition throughout the period of the study, 164 dyads continued to participate at 3 months, 158 at 6 months, 157 at 9 months, and 152 at 12 months postnatally.

Of the study mothers, 4.1% were <18 years old, 37.2% were between 18 and 25 years, 50% were between 26 and 35 years, and 8.7% were >35 years of age.

With respect to ethnicity, 75.4% were white non-Hispanic, 21.7% were Hispanic, and 2.9% were “other,” including black and Native American. Educational levels were less than high school graduate (15.8%), high school graduate (15.1%), attended college but did not graduate (41.3%), college graduate (19.8%), and advanced degree (8.0%). Twenty-three percent of the women were primiparous, 80.3% were married, and 16.1% were smokers. With respect to employment, 50.3% of the mothers worked outside the home during the first 6 months postpartum and 61.4% during the first year. The mean Hollingshead index score was 36.76 (SD: 12.16), and the mean Family Apgar scores for father/spouse and family were 8.25 (SD: 2.51) and 7.46 (SD: 2.60), respectively.

Prenatally, 144 mothers expressed an intention to breastfeed (82.8%). Of these, 1.4% planned to breastfeed for <1 month, 14.6% for 1 to 3 months, 25.7% for 4 to 6 months, 28.4% for 7 to 12 months, and 13.9% for >1 year; 16% were unsure of their intended duration of breastfeeding. With respect to actual practice, 141 mothers (81.0%) initiated breastfeeding, and prenatal intent to breastfeed correlated strongly with actual breastfeeding initiation ( $r[167] = 0.743; P < .001$ ). There were 101 mothers (61.6% of the current study population) who were breastfeeding at 3 months, 80 mothers (50.6%) breastfeeding at 6 months, 56 mothers (35.7%) breastfeeding at 9 months, and 38 mothers (25%) breastfeeding at 12 months. These breastfeeding rates were very close to the goals advised by the US Department of Health and Human Services in its *Healthy People 2010* recommendations.<sup>32</sup> Among the mothers who initiated breastfeeding, the mean duration of any breastfeeding was 6.07 months (SD: 4.69 months), and the mean duration of exclusive breastfeeding was 4.01 months (SD: 2.66 months). The expected duration of breastfeeding prenatally correlated with the actual duration of any breastfeeding ( $r[114] = 0.58; P < .001$ ). Of breastfeeding mothers, 59% were exclusively breastfeeding at 3 months, and 38.2% were exclusively breastfeeding at 6 months.

Of the study dyads evaluated in the Ainsworth Strange Situation, 56.6% were categorized as securely attached, 23.7% as insecure-avoidant, 17.1% as insecure-resistant, and 2.6% as unclassified. This distribution is similar to that generally reported for populations from the United States.<sup>33</sup> The mean score on the 6-month NCAST Feeding Scale was 58.69 (SD: 7.52), and the mean score on the 3-month Sensitivity to Cues subscale was 12.44 (SD: 2.28). These scores are similar to published values.<sup>29</sup> The interrater reliability ranged from 0.89 to 0.92, and the internal consistency reliability ( $\alpha$ ) ranged from 0.80 to 0.82. The 3-month sensitivity score correlated significantly with security of attachment in the Ainsworth Strange Situation<sup>30</sup> at 1 year ( $r[151] = 0.19; P = .023$ ) and remained a significant predictor of

secure attachment after controlling for demographic variables, with an adjusted odds ratio (OR) of 1.26 (95% confidence interval [CI]: 1.02–1.56). This magnitude of the relationship between sensitivity and security is consistent with that of previous studies.<sup>15,16</sup>

### First Hypothesis: Early Breastfeeding and Sensitivity

The first hypothesis was that mothers who chose to breastfeed would demonstrate more-sensitive parenting behavior in early infancy than those who selected formula feeding.

Compared with mothers who intended to formula feed, mothers who intended to breastfeed prenatally had significantly higher sensitivity scores at 3 months (Table 1). Among mothers who intended to breastfeed prenatally and expressed an expected breastfeeding duration, there was a significant correlation between intended duration of breastfeeding and sensitivity ( $r[108] = 0.26; P = .008$ ).

Those mothers who initiated breastfeeding had higher sensitivity scores than those who did not (Table 1). Among mothers who initiated breastfeeding, those who continued to breastfeed at 3 months had higher sensitivity scores than those who ceased breastfeeding by this time. Sensitivity scores were also higher among those who exclusively breastfed compared with those who did not. In 1-way ANOVA with posthoc Scheffe test ( $F_{2,159} = 20.73$ ), mothers who exclusively breastfed at 3 months had higher mean sensitivity scores (13.57 [SD: 1.76]) than those who partially breastfed (11.80 [SD: 2.19]) ( $P = .002$ ) and those who had ceased breastfeeding (11.59 [SD: 2.22];  $P < .001$ ). The latter 2 groups did not differ significantly.

### Second Hypothesis: Breastfeeding and Attachment

The second hypothesis was that mothers who breastfed during infancy would be more likely than those who formula fed to have secure attachment with their infants and that increased breastfeeding duration would be associated with enhanced attachment security.

When dyads were grouped among the 3 major attachment categories, there were no differences in the proportion of women who initiated breastfeeding or in the duration of any or exclusive breastfeeding among those

**TABLE 1** Sensitivity Scores Among Mothers With Different Early Breastfeeding Practices

	Yes			No		
	Mean	SD	n	Mean	SD	n
Prenatal intent	12.65 <sup>a</sup>	2.20	136	11.19 <sup>a</sup>	2.33	26
Initiation	12.75 <sup>b</sup>	2.20	135	11.04 <sup>b</sup>	2.16	27
Continued breastfeeding at 3 mo						
Any	13.21 <sup>b</sup>	1.98	99	11.59 <sup>b</sup>	2.22	34
Exclusive	13.57 <sup>b</sup>	1.76	79	11.67 <sup>b</sup>	2.19	54

Comparisons of means with like footnote symbols: <sup>a</sup>  $P < .005$ ; <sup>b</sup>  $P < .001$ .

who initiated (Table 2). When attachment was dichotomized as either secure or insecure, 85.7% of secure dyads initiated breastfeeding compared with 86.2% of insecure dyads ( $\chi^2_{1,149} = .006$ ;  $P = .939$ ). The mean duration of any breastfeeding for secure dyads was 6.12 months (SD: 3.14 months), similar to the 5.88 months (SD: 3.21 months) for insecure dyads ( $P = .785$ ). In addition, the mean duration of exclusive breastfeeding for secure dyads was 4.29 months (SD: 2.51 months) compared with the mean duration of 3.84 months (SD: 2.92 months) for insecure dyads ( $P = .588$ ). None of these differences were significant.

Sample-size analysis<sup>31</sup> revealed that the sample size was adequate to detect a 25% difference in breastfeeding initiation between secure and insecure dyads with an  $\alpha$  value of .05 and a power of 0.83. For breastfeeding duration, the sample was adequate to detect a 33% difference between the same groups with this  $\alpha$  value and a power of 0.82.

### Third Hypothesis: Early Breastfeeding Duration, Sensitivity, and Attachment

To test the hypothesis that breastfeeding in early infancy might foster secure attachment, either directly or through enhancement of maternal sensitivity, the relationship between early breastfeeding duration, sensitivity, and security was explored by path analysis. In bivariate analyses, early breastfeeding duration correlated with maternal sensitivity ( $r[162] = 0.39$ ;  $P = .000$ ) but not with security ( $r[148] = 0.03$ ;  $P = .75$ ). Prenatal intent to breastfeed correlated with early breastfeeding duration ( $r[162] = 0.71$ ;  $P = .000$ ) and with sensitivity ( $r[162] = 0.24$ ;  $P = .003$ ), suggesting that it might not only be an antecedent of lactation success but also of sensitive parenting. Consequently, all of these variables were included in the path model (Fig 1). Structural equation modeling based on maximum-likelihood estimation showed that the model fit the data well ( $\chi^2_{1,149} = .04$ ;  $P = .85$ ; root mean square error of approximation = 0.00). In this model, no significant contribution of early breastfeeding duration to either sensitivity or security was demonstrable. Other alternative models tested did not converge.

**TABLE 2 Breastfeeding Initiation and Duration Among Major Attachment Groups**

	Attachment Category		
	Secure	Avoidant	Resistant
Initiation, <i>n</i> (%) <sup>a</sup>	72 (85.7)	30 (83.3)	22 (88.0)
Duration, mean (SD), mo			
Any <sup>b</sup>	6.12 (3.14)	5.40 (3.14)	6.27 (3.24)
Exclusive <sup>c</sup>	4.29 (2.51)	2.58 (2.26)	5.04 (3.20)

<sup>a</sup>  $\chi^2_{2,145} = .266$ ;  $P = .876$ .

<sup>b</sup> ANOVA  $F_{2,121} = .299$ ;  $P = .742$ .

<sup>c</sup> ANOVA  $F_{2,119} = 2.09$ ;  $P = .128$ .

### Fourth Hypothesis: Breastfeeding, Quality of Dyadic Interaction, and Attachment

The next hypothesis was a question of whether breastfeeding per se, or the quality of the dyadic interaction irrespective of feeding type, would predict security of attachment.

Quality of the dyadic interaction, as assessed by the NCAST Feeding Scale at 6 months, did not differ among mothers who exclusively breastfed (mean: 59.55; SD: 7.91), partially breastfed (mean: 59.59; SD: 6.45), or bottle fed (mean: 57.52; SD: 7.63) (ANOVA:  $F_{2,152} = 1.43$ ;  $P = .24$ ). However, Feeding Scale scores were significantly higher among dyads later classified as securely attached compared with those classified as insecure (mean: 60.00 [SD: 6.23] vs 57.38 [SD: 8.74];  $P = .04$ ). In logistic-regression models containing covariates for either exclusive or any breastfeeding, the Feeding Scale score contributed significantly to security of attachment, with an adjusted OR of 1.05 (95% CI: 1.01–1.10;  $P < .05$ ); the breastfeeding parameters were not significant predictors of security in these models.

### Fifth Hypothesis: Sensitivity and Breastfeeding Duration

Next, the hypothesis that maternal sensitivity may predict breastfeeding duration was tested. Among mothers who initiated breastfeeding, mean sensitivity scores were higher for those who breastfed for 12 months (13.58 [SD: 1.70]) compared with those who did not (12.46 [SD: 2.21];  $t = 3.08$ ;  $P = .003$ ). In addition, the mean scores were higher for those who breastfed exclusively for at least 6 months (13.59 [SD: 1.84]) compared with those who did not (12.30 [SD: 2.17];  $t = 3.47$ ;  $P = .001$ ). For mothers who initiated breastfeeding, sensitivity correlated significantly with duration of any ( $r[135] = 0.32$ ;  $P < .001$ ) and exclusive ( $r[131] = 0.41$ ;  $P < .001$ ) breastfeeding.

Because demographic and social variables are known to influence breastfeeding, linear-regression models were constructed next, with breastfeeding duration as the dependent variable and these factors as predictors added on the first block. Maternal sensitivity was then added on the second block (Table 3). All models included maternal age, education, ethnicity, smoking, and employment status, because these variables are the most well-substantiated predictors of lactation performance.<sup>24</sup> In these analyses, sensitivity remained a significant predictor of the duration of any breastfeeding during the first year, accounting for 6% of the variance in this variable (Table 3). In similar models, sensitivity significantly predicted the duration of exclusive breastfeeding, accounting for 8% of the variance in this outcome (Table 3). Addition of variables for other less well-substantiated predictors of lactation performance, including parity, marital status, Hollingshead index, and spousal and family support, neither improved the models nor obviated the significant contribution of sensitivity to the criterion.

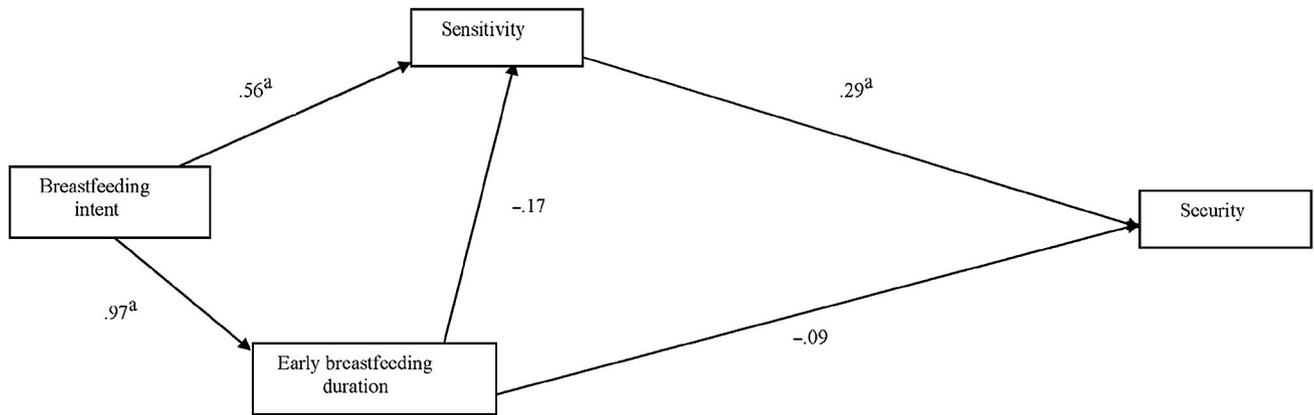


FIGURE 1  
Hypothesized structural relations and path coefficients between breastfeeding intent and attachment security. <sup>a</sup>  $P < .05$ .

TABLE 3 Sensitivity as a Predictor of Breastfeeding Duration

Variables Entered	B	SE	$\beta$	F	$R^2$	$\Delta R^2$	$R^2_{\text{adjusted}}$	SE <sub>est</sub>
Any breastfeeding								
Model 1				13.05 <sup>d</sup>	0.36	0.36	0.33	1.27
Age	0.45	0.17	0.20 <sup>a</sup>					
Education	0.33	0.10	0.25 <sup>c</sup>					
Ethnicity	0.71	0.30	0.18 <sup>a</sup>					
Employment	-1.37	0.25	-0.42 <sup>d</sup>					
Smoking	-0.06	0.39	-0.01					
Model 2				13.98 <sup>c</sup>	0.42	0.06	0.39	1.21
Age	0.44	0.16	0.20 <sup>b</sup>					
Education	0.26	0.10	0.20 <sup>a</sup>					
Ethnicity	0.78	0.29	0.20 <sup>b</sup>					
Employment	-1.20	0.24	-0.37 <sup>d</sup>					
Smoking	0.03	0.38	0.01					
Sensitivity	0.19	0.06	0.26 <sup>c</sup>					
Exclusive breastfeeding								
Model 1				8.36 <sup>d</sup>	0.26	0.26	0.23	1.36
Age	0.30	0.18	0.14					
Education	0.31	0.11	0.24 <sup>b</sup>					
Ethnicity	0.66	0.31	0.17 <sup>a</sup>					
Employment	-1.12	0.25	-0.37 <sup>d</sup>					
Smoking	-0.25	0.42	-0.05					
Model 2				10.27 <sup>d</sup>	0.34	0.08	0.31	1.28
Age	0.26	0.17	0.12					
Education	0.22	0.11	0.17 <sup>a</sup>					
Ethnicity	0.71	0.29	0.18 <sup>a</sup>					
Employment	-0.96	0.24	-0.31 <sup>d</sup>					
Smoking	-0.14	0.40	-0.03					
Sensitivity	0.22	0.06	0.30 <sup>d</sup>					

SE<sub>est</sub> indicates standard error of the estimate. Levels of significance: <sup>a</sup>  $P < .05$ ; <sup>b</sup>  $P < .01$ ; <sup>c</sup>  $P < .005$ ; <sup>d</sup>  $P < .001$ .

Next, logistic-regression models were constructed with sensitivity as the predictor, controlling for the same covariates as mentioned above but with any breastfeeding at 12 months and exclusive breastfeeding at 6 months as dependent variables. In the first model, the adjusted OR was 1.45 (95% CI: 1.09–1.91;  $P < .05$ ) for any breastfeeding at 12 months. For exclusive breastfeeding at 6 months, the adjusted OR was 1.89 (95% CI: 1.35–2.66;  $P < .001$ ).

## DISCUSSION

This study is the first to explore the relationship among breastfeeding, sensitivity, and attachment security. The results demonstrate an association between breastfeeding and maternal sensitivity, thereby establishing a link between attachment theory and infant feeding behaviors not previously described. However, no direct relationship between attachment security and breastfeeding was demonstrable in the population studied.

Our data suggest that mothers who choose breastfeeding over bottle feeding may be more likely to be sensitive in responding to the cues of their infants in dyadic interactions in early infancy. Not only did sensitivity correlate with the initiation of breastfeeding, but it was also greater among mothers who continued to exclusively breastfeed their infants through 3 months postnatally. Moreover, sensitivity was associated with prenatal intent to breastfeed and with the intended duration of breastfeeding prenatally, suggesting that intent may be an early marker for later maternal sensitivity. Finally, compared with breastfeeding mothers with low sensitivity, mothers with high sensitivity were more likely to breastfeed either partially or exclusively for longer periods during infancy.

Among the possible explanations for these associations is that mothers destined to be more sensitive parents will be more likely, perhaps because of their intrinsic personality characteristics, to choose breastfeeding even before the birth of the infant and to continue to breastfeed longer and more exclusively. This possibility implies that breastfeeding and sensitivity may have common, perhaps as-yet undetermined, antecedent personality characteristics. The limited literature comparing personality characteristics of mothers breastfeed and bottle feed is consistent with this notion. Compared with mothers who bottle feed their infants, breastfeeding mothers have been reported to provide a more enriched home environment for the infant, together with greater variety of daily stimulation and play and less authoritar-

ian parenting approaches.<sup>2,34</sup> In addition, a number of reports support the general conclusion that infant-centered, rather than mother-centered, considerations regarding the mode of feeding are more commonly observed among mothers who choose breastfeeding over bottle feeding.<sup>35–39</sup> Such reports led Sauls,<sup>40</sup> in a review of the literature on associations of psychological variables with infant-feeding practices, to conclude that breastfeeding mothers may place more importance on affection than bottle-feeding mothers.

An alternative explanation for the relationship between breastfeeding and sensitivity is that the actual experience of early breastfeeding fosters the development of maternal sensitivity. This mechanism was not supported by our data, however. Although sensitivity correlated with early breastfeeding duration, no significant relationship between early duration and sensitivity was demonstrable in our path model.

Similarly, no direct relationship between attachment security and breastfeeding initiation or duration was demonstrable in bivariate analyses, and a path analysis did not suggest a contribution of early breastfeeding duration to attachment security, either directly or indirectly via sensitivity. In addition, our regression models suggest that the quality of the dyadic interaction, rather than the type of feeding, may predict security, a finding entirely consistent with Bowlby's<sup>19,20</sup> early predictions. Yet, the power of the study was inadequate to detect subtle differences in breastfeeding practices among attachment groups, such that a direct relationship between breastfeeding and attachment security cannot completely be eliminated by our data. It is also possible that the indirect path between breastfeeding intent and security mediated by sensitivity may be of greatest importance, especially in light of the strength of the association between intent and sensitivity, which exceeds that between sensitivity and security.

It should be noted that although much is known about the determinants of prenatal breastfeeding intent, less is understood about the factors that predict breastfeeding duration.<sup>24</sup> Our observation that maternal sensitivity accounts for 6% to 8% of the variance in the duration of breastfeeding during the first year postnatally clearly identifies sensitivity as the first established maternal behavioral characteristic that may predict breastfeeding duration independently of demographic and social factors. Although causation may not be concluded from our data, the findings support the notion that more sensitive breastfeeding mothers, perhaps because of greater consistency, appropriateness, and infant centered concern, may breastfeed their infants for longer periods of time.

Recent reports suggest that breastfeeding during infancy may lead to enhanced cognitive ability and educational achievement later in childhood.<sup>2–5,41</sup> Breastfed infants also have been reported to have reduced rates of

a variety of childhood morbidities compared with bottle-fed infants.<sup>1</sup> Although intrinsic characteristics of breast milk seem to contribute to some of these outcomes, the existence of other contributory mechanisms remains plausible. The association between sensitivity and breastfeeding observed in our study suggests that sensitivity among breastfeeding mothers could contribute to enhanced cognitive ability of the child, perhaps through fostering of intellectual development. In support of this notion are reports that consistent responsiveness in early childhood may predict enhanced cognitive and social growth.<sup>42,43</sup> Sensitive parenting among breastfeeding mothers might also contribute to lower childhood morbidity, possibly because of more attentive preventive medical care. Such associations are entirely speculative, however, and additional studies will be required to explore these possibilities.

There are several limitations of our study. First, the cohort evaluated was almost certainly subject to selection bias in that the mothers enrolled electively and agreed to participate in repeated evaluations throughout the first postpartum year. Thus, they may have represented a group with greater parenting capabilities and interests than those who chose not to participate. It is conceivable that a direct relationship between breastfeeding and attachment might have been demonstrable in a larger, more diverse, and randomly selected population subjected to interventions to promote breastfeeding, especially one in which breastfeeding rates and parenting capabilities were initially low. A randomized, controlled trial would seem most desirable, yet given the current known advantages of breastfeeding over bottle feeding, obvious ethical considerations would prohibit such a study.

Programs to specifically promote breastfeeding have been described, and some have been shown to foster improved infant health at the community level.<sup>44–46</sup> Similarly, interventions to enhance maternal sensitivity have been reported, and some have been found to improve security of attachment.<sup>47</sup> The link between sensitivity and breastfeeding reflected by our data thus suggests the possibility that interventions to augment sensitivity might not only enhance security but also increase breastfeeding. Because current breastfeeding rates remain below desirable levels despite interventional efforts,<sup>27,32</sup> additional studies to address this possibility would seem warranted.

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