Associations Between Postpartum Depression, Breastfeeding, and Oxytocin Levels in Latina Mothers

Sandraluz Lara-Cinisomo,¹ Kathryn McKenney,² Arianna Di Florio,^{3,4} and Samantha Meltzer-Brody³

Abstract

Background: Postpartum depression (PPD), often comorbid with anxiety, is the leading medical complication among new mothers. Latinas have elevated risk of PPD, which has been associated with early breastfeeding cessation. Lower plasma oxytocin (OT) levels have also been associated with PPD in non-Latinas. This pilot study explores associations between PPD, anxiety, breastfeeding, and OT in Latinas.

Materials and Methods: Thirty-four Latinas were enrolled during their third trimester of pregnancy and followed through 8 weeks postpartum. Demographic data were collected at enrollment. Depression was assessed using the Edinburgh Postnatal Depression Scale (EPDS) at each time point (third trimester of pregnancy, 4 and 8 weeks postpartum). The Spielberger State-Trait Anxiety Inventory (STAI) was administered postpartum and EPDS anxiety subscale was used to assess anxiety at each time point. Breastfeeding status was assessed at 4 and 8 weeks postpartum. At 8 weeks, OT was collected before, during, and after a 10-minute breast/bottle feeding session from 28 women who completed the procedures. Descriptive statistics are provided and comparisons by mood and breastfeeding status were conducted. Analyses of variance were used to explore associations between PPD, anxiety, breastfeeding status, and OT.

Results: Just under one-third of women were depressed at enrollment. Prenatal depression, PPD, and anxiety were significantly associated with early breastfeeding cessation (i.e., stopped breastfeeding before 2 months) ($p < 0.05$). There was a significant interaction between early breastfeeding cessation and depression status on OT at 8 weeks postpartum ($p < 0.05$).

Conclusions: Lower levels of OT were observed in women who had PPD at 8 weeks and who had stopped breastfeeding their infant by 8 weeks postpartum. Future studies should investigate the short- and long-term effects of lower OT levels and early breastfeeding cessation on maternal and child well-being.

Keywords: postpartum depression, anxiety, oxytocin, Latina, breastfeeding, early breastfeeding cessation

Introduction

MORE THAN HALF of mothers in the United States who initiate breastfeeding do not breastfeed for as long they intend.¹ This is an important public health concern because breastfeeding is associated with lower maternal risk of breast and ovarian cancers along with lower infant risk of certain infectious diseases, leukemia, diabetes mellitus, and sudden infant death syndrome.² Early breastfeeding cessation has been associated with postpartum depression (PPD),³ the leading medical complication among new mothers.⁴ In the United States, 10–19% of women in the general population⁵ and about 43% of Latinas⁶ experience PPD.

Results from previous research suggest that PPD and early breastfeeding cessation may share a neuroendocrine mechanism involving plasma oxytocin (OT).^{7,8} OT is a peptide hormone released during labor, breastfeeding, and psychosocial stress.⁹ OT is involved in bonding, has anxiolytic properties, and tempers the hypothalamic pituitary-adrenal axis response during stress.^{10,11} Lower levels of plasma OT during pregnancy and shortly after delivery are associated with depressive symptoms.^{7,12} Skrundz et al.¹² found that low levels of OT during pregnancy were predictive of high depressive symptoms 2 weeks postpartum in a sample of 73 Swedish women. Stuebe et al.⁷ found similar associations in a sample of 39 non-Latina women at 8 weeks postpartum,

¹Department of Kinesiology & Community Health, University of Illinois at Urbana-Champaign, Urbana, Illinois.

²Feinberg School of Medicine, Northwestern University, Chicago, Illinois.

³Department of Psychiatry, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina.

⁴Division of Psychological Medicine and Clinical Neurosciences, MRC Centre for Neuropsychiatric Genetics and Genomics, Cardiff University, Cardiff, Wales.

with lower levels of OT released during breastfeeding found in women with depression than in women without depression. A recent study found that OT released during breastfeeding tempers subsequent cortisol release in response to stress, with dysregulation of this effect among women with depressive symptoms.⁸

The neuroendocrine response to breastfeeding and its relationship to PPD have not been studied in Latina women. An examination of the neuroendocrine response in immigrant and U.S.-born Latinas is important. First, Latinas have high rates of psychosocial stress and PPD¹³; second, the literature documents an association between psychosocial stress and early breastfeeding cessation¹⁴; and third, OT has a tempering effect on mood and stress response.⁸ Latinas are also an important group to understand because although they have high rates of breastfeeding initiation, their duration of any and exclusive breastfeeding falls short of the recommended levels.^{15–18} Latina mothers are more likely to feed their infants both formula and breastmilk, a behavior associated with earlier breastfeeding cessation.¹⁵ However, differences have been shown in breastfeeding behavior of immigrant Latina women versus U.S.-born Latina women: one prevalence study found 14% more immigrant Latinas initiated breastfeeding than U.S.-born Latinas.¹⁹ Studies have also shown that Latinas who are more acculturated (i.e., who have adopted host country values and practices to a higher degree) are less likely to breastfeed than Latinas who are less acculturated.¹⁶

Understanding the association between the neuroendocrine response and varying degrees of breastfeeding and maternal mood is needed because Latinas are at particular risk for psychosocial stressors,¹³ PPD,²⁰ and suboptimal breastfeeding duration and exclusivity.¹⁵ The objective of this pilot study was to explore associations between breastfeeding practices, OT levels in response to infant feeding, and PPD in Latinas to generate hypotheses to test in a larger sample of Latinas.

Materials and Methods

Women were approached and screened for eligibility during routine prenatal visits at the University of North Carolina at Chapel Hill and nearby community centers by trained bilingual (Spanish and English) female research assistants (RA). To be eligible to participate, women had to self-identify as Latina, have a singleton pregnancy, be able to read, write, and speak English or Spanish, intend to breastfeed ≥ 2 months, and be willing to be followed until 8 weeks postpartum. Exclusion criteria included reported maternal or infant disorder that might interfere with breastfeeding, substance use, and current or past severe psychiatric disorder other than unipolar depression or anxiety (e.g., bipolar disorder). After determining eligibility, women were invited to enroll in the study.

Women were assessed in person during their third trimester of pregnancy, by phone at 4 weeks postpartum, and in person at 8 weeks postpartum during a 2-hour laboratory visit. Validated measures were used in English and Spanish. Our study screened 65 self-identified prenatal Latinas who agreed to learn more about the study from the RA; of these, 34 were enrolled in the study, with 4 lost before the 8 week laboratory visit (Fig. 1).

FIG. 1. Subject flowchart showing recruitment, enrollment, and participation counts.

During the enrollment interview, demographic information was collected and a comprehensive psychological assessment was conducted. During the phone interview at 4 weeks postpartum, data on depression, anxiety, daily stressors, and breastfeeding practices were collected. At the laboratory visit at 8 weeks postpartum, blood samples were drawn, depression, anxiety, and stress were assessed and participants completed self-administered surveys.

The study was approved by the University of North Carolina at Chapel Hill Institutional Review Board. At enrollment, women gave written informed consent. Women were compensated \$50 after the enrollment visit, \$10 gift card after the phone interview, and \$60 after the laboratory visit.

Measures and data collection

Depression status was assessed at each time point using the Edinburgh Postnatal Depression Scale (EPDS).^{21,22} The EPDS is a 10-item instrument widely used to assess depression post-delivery and has also been shown to be valid during the prenatal period.²³ Depression was determined using a cutoff score of EPDS ≥ 10 , which is the recommended cutoff for capturing minor and major depression.²⁴

Because PPD is also often comorbid with anxiety²⁵ and has been associated with early breastfeeding cessation,²⁶ we examined associations between breastfeeding status and anxiety using the following two measures: the Spielberger State-Trait Anxiety Inventory (STAI) and EPDS anxiety subscale. We decided to include both measures of anxiety because the STAI is specifically designed to assess a wide range of feelings associated with anxiety (e.g., nervousness

and worry) whereas the EPDS anxiety subscale, made up of three items, captures feelings that might be unique to comorbidly depressed mothers (i.e., feelings of guilt). The three-item EPDS anxiety subscale has been shown to reliably capture anxiety in postpartum women.²⁷ The sum of the three items is used to compute a EPDS anxiety subscale score and a cutoff of 5 is used to determine high and low anxiety.²⁷

The STAI is a self-reported inventory of anxiety^{28,29} that has been validated for use with perinatal women.³⁰ This four-point Likert-type scale includes 40 items to assess state and trait anxiety, with 20 items in each subscale. For this study, current anxiety was determined using the state subscale (STAI-S). Scores are summed for a total subscale score. A cutoff score of 40 is recommended to detect clinically significant symptoms (high versus low).^{31,32} Anxiety assessments using the STAI were obtained only at 4 and 8 weeks postpartum. The continuous summed score for state or current anxiety was used in the analysis.

The Acculturation Rating Scale for Mexican-Americans-II³³ was used to determine level of acculturation (points on the scale include very Latina, Latina approaching bicultural, and slightly Anglo bicultural, strongly Anglo, and very assimilated); Latina was used to replace the term Mexican-American.³⁴ Due to an error during the preparation of the interview packets, we only had data for 24 women.

The Infant Feeding Practices Survey (IFPS) II³⁵ questionnaire was used at 4 and 8 weeks postpartum to determine breastfeeding status. The IFPS-II is designed to assess whether a mother ever breastfed her infant, whether she has stopped breastfeeding or pumping milk for her infant, and when the woman stopped breastfeeding or pumping milk. Response to the question of whether the woman had stopped breastfeeding or pumping milk was used to determine early breastfeeding cessation at 4 and 8 weeks. Response options were coded yes or no.

At 8 weeks postpartum, each woman returned to the hospital with her infant, where she was observed in an infant feeding session. The laboratory protocol was modeled after a recent study examining the associations between PPD, breastfeeding intensity, and OT function in non-Latina women and included blood draws and self-assessed mood ratings.⁷

Each laboratory visit began at 9:00 a.m. Upon arrival, the mother and infant were separated; the infant was taken to be cared for by a trained research assistant and the mother was seated in the laboratory in a comfortable chair. There, a trained nurse placed an intravenous (IV) catheter in the woman's antecubital vein to collect blood for OT analysis; the IV remained in place for the duration of the laboratory procedures. The woman was asked to remain seated and read home improvement magazines for a 10-minute habituation period before starting the infant feeding session. At the beginning of this 10-minute habituation period, a blood sample was drawn by the trained nurse using the established IV. At the same time, in a separate room, the infant was prepared for the infant feeding session by ensuring it had a clean diaper and was rested.

After the 10-minute habituation period, the infant was brought in and placed in the woman's arms while she remained seated. The woman was instructed to feed her infant for at least 10 minutes and was given the choice of breastfeeding or bottle feeding; women provided their own bottle and formula and infant care staff prepared the formula according to mothers' instructions. Feeding duration was cap-

tured in minutes and seconds. The woman fed her infant privately while the nurse, from behind a curtain, drew blood for samples of OT. During the infant feeding period, blood was collected at 3, 7, and 10 minutes. The sample timing was determined based on prior research with postpartum women and the pulsatile nature of the hormone.⁷

After feeding, the mother indicated that she was ready for the infant to be returned to the infant care room by the trained research assistant. The woman remained seated in the laboratory chair where she rested for 10 minutes. After 10 minutes of postfeeding rest, blood was again collected.

Blood samples were collected in prechilled vacutainer tubes, which were transported to the processing laboratory located a few feet from the infant feeding room. The samples were then cold-centrifuged and aliquoted into prechilled cryotubes and stored in a refrigerator at the required -80°C . Enzyme immunoassay with extraction (Enzo Life Sciences, Farmingdale, NY) was used to assay the samples based on previous studies.⁷ The sensitivity of the assay was 11.7 pg/mL with a standard range of 7.5–1,000 pg/mL; intra-assay variation was 4.8% and inter-assay variation was 8%.

Data analysis

Subject characteristics were summarized using frequencies and descriptive statistics. Fisher's exact tests were used to assess associations between demographic characteristics, which were dichotomized, depression status at each time point, and breastfeeding status at 4 and 8 weeks postpartum. Chi-square tests were used to determine the associations among acculturation level, depression status, and breastfeeding status. We conducted Spearman rank-order correlations to determine associations between EPDS depression scores, EPDS anxiety subscale scores and STAI-S anxiety scores at 8 weeks.

One-way analyses of variance (ANOVA) were used to explore differences in continuous outcomes (e.g., anxiety scores) and categorical predictors (e.g., acculturation level, breastfeeding cessation—yes/no). Two-way ANOVAs were also used to test differences in OT area under the curve (AUC) by depression status (yes/no) or anxiety status (high versus low) and breastfeeding cessation (yes/no). Because of the pulsatile nature of OT, AUC was calculated to capture the repeated measurement of OT, which also allows for the use of one variable that represents the overall concentration of the hormone collected during the infant feeding episode.^{7,36}

Given the exploratory nature of this study, we did not control for multiple testing or repeated measures. However, because of our small sample, bootstrapping was used in all bivariate and multivariate analyses. Results are based on 1,000 bootstrap samples. Analyses were conducted in SPSS 23 (version 21.0; IBM Corp., Armonk, NY).

Results

Sample characteristics

Of the 34 women enrolled, 4 women were lost to follow-up before the 8-week laboratory visit (Fig. 1). There were no significant differences in depression status or demographic characteristics between the women who attended the laboratory visit and those lost to follow-up. However, two were depressed in the interview before dropping out, one woman

was employed at enrollment, and two were slightly more educated having completed high school or more. Of the 30 women who attended the laboratory visit, 28 completed the entire protocol and the two prior interviews; we were unable to establish an IV in 2 women. Thus, the analysis is based on the 28 women for whom complete data were available.

As Table 1 shows, 64% of women ($n=18$) were multiparous and 57% ($n=16$) reported a history of breastfeeding. Eighty-six percent were immigrants ($n=24$) and 82% preferred to speak Spanish ($n=23$). Among immigrant women, half had been in the United States for 10 years or less. Eighty-two percent were married or cohabiting ($n=23$), 79% were not employed at the time of enrollment ($n=22$), and fewer than half had more than a high school education ($n=12$, 43%). Of the 19 women who completed the acculturation assessment, 32% ($n=9$) were classified as having a "very Latina orientation," 21% ($n=6$) were identified as having a "Latina ap-

proaching bicultural orientation," and 14% ($n=4$) were defined as having a "slightly Anglo orientation," the last meaning more acculturated. At enrollment, 29% ($n=8$) women met the EPDS cutoff (≥ 10) for depression; 18% ($n=5$) were depressed at 4 weeks postpartum, and 21% ($n=6$) were depressed at the 8-week laboratory visit. While there was little variation in the proportion of women who met the cutoff for high anxiety using the EPDS subscale and STAI-S (Table 1), there was no significant correlation between the two measures.

Based on results from the Fisher's exact test, there was a significant difference in the proportion of depression by immigrant status ($p=0.011$); U.S.-born women had significantly higher proportions of PPD at 4 weeks postpartum than immigrant women. Results from the one-way ANOVA indicated that there was a significant association between years in the United States and depression status among immigrant women; fewer years was associated with higher proportion of depression in pregnancy [$F(1, 22)=4.41$, $p=0.054$] and 8 weeks postpartum [$F(1, 22)=6.93$, $p=0.015$]. There was also a significant association between language preference and depression status at 4 weeks postpartum ($p=0.027$); however, women who chose to be assessed in Spanish had a lower probability of depression than women assessed in English. Related, results from the chi-square test also indicated that there was a significant association between acculturation level and depression status at 4 weeks postpartum ($\chi^2 [2, n=19]=8.26$, $p=0.016$); less acculturated women (i.e., those with a very Latina orientation) were less likely to be depressed.

Anxiety as measured by the EPDS subscale score also differed significantly by acculturation level at 4 weeks postpartum [$F(2, 16)=19.15$, $p=0.001$]; less acculturated women had significantly lower mean scores ($M=0.78$, $SD=0.83$) than women who were more bicultural ($M=4.33$, $SD=1.97$) and women who were more acculturated ($M=5.75$, $SD=1.89$). There were no significant association between STAI-S and any demographic characteristics.

At 4 weeks postpartum, 14% ($n=4$) of mothers completely stopped breastfeeding and 18% ($n=5$) stopped by 8 weeks postpartum. Results from the Fisher's exact test indicated that there was a significant association between immigrant status and early breastfeeding cessation at 4 and 8 weeks postpartum ($p=0.005$ and $p=0.011$, respectively), with immigrant women less likely to stop breastfeeding. There was also a significant relationship between language preference and breastfeeding cessation at 4 weeks postpartum ($p=0.011$) and 8 weeks postpartum ($p=0.027$); women who preferred to be interviewed in Spanish were more likely to continue breastfeeding than women who preferred English. Results from the chi-square test indicated that there was a significant association between acculturation level and breastfeeding status, with less acculturated women more likely to continue breastfeeding at 4 weeks postpartum ($\chi^2 [2, n=19]=13.36$, $p=0.001$) and 8 weeks postpartum ($\chi^2 [2, n=21]=4.83$, $p=0.089$) than more acculturated women.

Associations between maternal mood and breastfeeding duration

Results from Fisher's exact test showed that there was a significant association between prenatal depression and breastfeeding cessation at 8 weeks postpartum ($p=0.015$); there was a marginally significant association between

TABLE 1. DESCRIPTIVE STATISTICS OF THE SAMPLE ($N=28$)

Age in years, mean (SD) ^a	29.50 (6.22)
Immigrant status, n (%)	
Foreign-born	24 (86)
U.S.-born	4 (14)
Language preference, n (%)	
Spanish	23 (82)
English	5 (18)
Marital status, n (%)	
Married or cohabitating	23 (82)
Single	5 (18)
Education, n (%)	
Less than high school	16 (57)
High school or more	12 (43)
Employment status at enrollment, n (%) ^a	
Not employed	22 (79)
Employed	6 (21)
Family income, n (%) ^a	
Less than \$20,000	11 (44)
\$20,000 or more	14 (56)
Parity, n (%) ^a	
Primiparous	10 (36)
Multiparous	18 (64)
History of breastfeeding, n (%) ^b	16 (57)
History of depression, n (%) ^a	
Yes	15 (42)
No	11 (58)
Depressed (EPDS ≥ 10), n (%)	
Prenatal	8 (29)
4 weeks postpartum	5 (18)
8 weeks postpartum	6 (21)
High EPDS anxiety subscale score ≥ 5 , n (%)	
Prenatal	26 (93)
4 weeks postpartum	23 (82)
8 weeks postpartum	25 (89)
High STAI-S score ≥ 40 , n (%)	
Prenatal	25 (89)
4 weeks postpartum	26 (93)
8 weeks postpartum	26 (93)

^aBased on available data.

^bAmong all women who responded.

EPDS, Edinburgh Postnatal Depression Scale; STAI-S, Spielberger State-Trait Anxiety Inventory-State scale.

prenatal depression and breastfeeding cessation at 4 weeks postpartum ($p=0.058$). There was also a significant association between depression at 4 weeks postpartum and early breastfeeding cessation at both 4 ($p=0.011$) and 8 weeks postpartum ($p=0.001$).

Women who stopped breastfeeding at 4 weeks had significantly higher mean prenatal EPDS anxiety subscale scores than women who continued to breastfeed [$F(1, 26)=7.34$, $p=0.012$] ($M=5.25$, $SD=0.50$ and $M=2.25$, $SD=2.17$, respectively). We also found that women who stopped breastfeeding at 8 weeks postpartum had significantly higher mean EPDS anxiety subscale scores at each time point: third trimester of pregnancy [$F(1, 26)=19.08$, $p<0.001$], 4 weeks postpartum [$F(1, 26)=16.23$, $p<0.001$], and 8 weeks postpartum [$F(1, 26)=11.78$, $p=0.002$]. There were no significant associations between breastfeeding status and STAI-S anxiety scores at 4 and 8 weeks postpartum.

Results from the observed infant feeding session

At the time of the laboratory visit, 21 (75%) women breastfed their infant and 7 (25%) bottle-fed; however, 2 of those who bottle-fed had not stopped breastfeeding. Results from the ANOVA showed a significant association between laboratory feeding duration and laboratory feeding mode, with those who bottle-fed doing so for shorter durations [$F(1, 26)=4.74$, $p=0.039$]. ANOVA results also showed a negative association between PPD at 4 weeks postpartum and feeding duration [$F(1, 26)=5.198$, $p=0.031$].

To further understand the associations between breastfeeding cessation, depression, anxiety, and OT AUC, we conducted two-way ANOVAs, with depression and anxiety tested in separate models. Our results indicated that there was an interaction between PPD and breastfeeding status at 8 weeks postpartum. We found that women who were depressed at 8 weeks postpartum and had stopped breastfeeding by 8 weeks (i.e., exclusively bottle-fed) exhibited lower OT during the infant feeding observation than women who stopped breastfeeding but were not depressed at the time of the assessment [$F(1, 24)=4.51$, $p=0.044$]. Women who stopped breastfeeding by 8 weeks postpartum and were depressed at the time of the assessment had lower OT AUC ($M=570.65$, $SD=142.94$) compared to women who stopped breastfeeding but were not depressed ($M=803.96$, $SD=16.31$). Women who had not stopped breastfeeding and were depressed ($M=685.67$, $SD=161.00$) and those who were not depressed ($M=807.09$, $SD=90.75$) had higher mean OT AUC than women who were both depressed and no longer breastfeeding; the difference in OT AU between the women who had not stopped breastfeeding was not statistically significant. No other significant interactions were found (e.g., AUC, anxiety, and breastfeeding status).

Discussion

Given the high rates of depression among Latinas,³⁷ our findings provide new information about potential associations between PPD, early breastfeeding cessation, and OT in Latina mothers. Results from our analysis indicate that there was an interaction between depression status, breastfeeding cessation, and OT assessed at 8 weeks postpartum: women who had PPD and who had stopped breastfeeding exhibited significantly lower OT AUC than who stopped breastfeeding but

were not depressed. While it has been shown that women who supplement with formula exhibit lower levels of OT than women who exclusively breastfeed,³⁸ this is the first study that we know of to show an interaction between feeding mode, PPD, and OT. Previous studies have shown an association between depression and OT levels in a sample of middle class non-Latina mothers.⁷

The relationship between PPD, early breastfeeding cessation, and differences in OT levels observed in our study suggests an important physiologic implication of early breastfeeding cessation among depressed women. Prior research on human and animal models have demonstrated several health and psychological benefits to breastfeeding, resulting from the positive effects of OT.³⁹ Our study revealed that early breastfeeding cessation and PPD were associated with lower OT levels. Observationally, we also found that women who were depressed but had not stopped breastfeeding by the 8 week postpartum visit exhibited higher, though not statistically significant, OT AUC compared to women who had not stopped breastfeeding and were not depressed. Additional analysis by feeding type (e.g., bottle only, exclusive breastfeeding, and formula supplementation) did not explain these differences. Given the exploratory nature of this study, the results should be taken with caution, but should serve as the basis for further analysis. For instance, further exploration of mechanisms involved in higher OT, such as parent-child attachment and early childhood attachment experiences in mothers should be examined as should interactions during infant feeding session, which might help explain differences in OT reported here.⁴⁰

Results also revealed that prenatal depression and PPD was associated with early breastfeeding cessation. These findings are congruent with the current literature showing that women who suffer from depression are at increased risk of discontinuing breastfeeding earlier than nondepressed women,⁴¹ highlighting the importance of early detection by practitioners and early assessment in future studies. Related, we found that higher anxiety scores on the EPDS subscale were associated with early breastfeeding cessation. Prior research has shown that women with high levels of prenatal⁴² and postpartum anxiety²⁶ are significantly more likely to stop breastfeeding earlier than women without anxiety.²⁶ It is important to note that anxiety as measured by the STAI-S was not significantly associated with depression or breastfeeding cessation whereas the EPDS anxiety subscale yielded significant findings. Also, while most women met the cutoff for high anxiety using both measures EPDS anxiety subscale and STAI-S subscale scores were not significantly correlated, suggesting that they are capturing distinct symptoms. We suggest that the EPDS subscale more directly captures anxiety more closely associated with depression in the perinatal period (e.g., guilt and worry). However, this is preliminary based on the observational results of one pilot study and should be systematically assessed in subsequent studies. Also, given that the EPDS was used to assess depression and anxiety, it will be important to include measures of anxiety that capture symptoms more closely associated with depression during the perinatal period that are not correlated with the depression measure. Still, given the comorbidity of depression and anxiety,⁴³ practitioners should assess the presence of both these conditions in all prenatal and postpartum women, particularly among those who wish to

breastfeed. Given the role OT plays in bonding, we think future studies should be conducted to examine the implications of our findings on mother-child attachment.

Finally, our results indicated that immigrant women, those who preferred to be interviewed in Spanish and less acculturated women, were significantly more likely to continue breastfeeding than their counterparts. Our findings are consistent with previous studies that have demonstrated similar associations^{16,19,44} and highlight the need to support and promote breastfeeding continuation among U.S.-born Latinas and among more acculturated Latina mothers. Acculturation level and years in the United States were also significantly associated with depression status. While proximity of migration was associated with depression, less acculturation was protective as was language preference—a proxy of acculturation. While the effect of acculturation on depression in Latina mothers is equivocal, the results reported here suggest that researchers should examine various factors of acculturation (e.g., years in the United States, language, and acculturation levels) to allow for a more nuanced examination of this complex factor, primarily because acculturation and language preferences were also significantly associated with early breastfeeding cessation.

Future studies should explore why less acculturated women are less likely to be classified as depressed and more likely to continue breastfeeding. One possible explanation might be the potential buffering effects of various forms of support less acculturated women may experience during the postpartum period. However, this hypothesis should be tested.

This study has some limitations. Our pilot study had a small sample size so results should be viewed with caution. While we used bootstrapping to address our sample size, a larger sample is needed to confirm our findings. Second, there were few U.S.-born Latinas in our sample, making the results generalizable to a mostly immigrant population of Latinas with a history of breastfeeding experiences who prefer Spanish and who reflect our sample characteristics. To address this limitation, subsequent studies should enroll larger numbers of Latinas, including those born in the United States. A third limitation is the lack of control for confounding variables that might explain the associations reported here. Fourth, subsequent studies should include neuroendocrine assessments collected earlier in the postpartum period (e.g., 4 weeks postpartum) to help explain the directionality of the associations found at 8 weeks postpartum.

Feeding duration will also be important to explore further as we found that women who bottle-fed their infant ended the feeding session earlier than women who breastfed. An examination of the associations between feeding duration and mood and between feeding mode (breast versus bottle) and OT might yield important findings. Finally, given the exploratory nature of this study, another limitation was the absence of control for multiple testing and repeated measures on the same individual. To address this limitation, future studies should employ Bonferroni correction and compare repeated observations (e.g., depression) over time.

Conclusions

This is the first study to show the potential negative implications of PPD and early breastfeeding cessation on OT. It highlights the need to integrate neurological measures

in studies that explore breastfeeding and mood in Latina women, who have been shown to experience high rates of PPD and have complex breastfeeding patterns. This study also highlights the importance of identifying meaningful factors associated with breastfeeding durations in Latina women to identify potential intervention points.

Disclosure Statement

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Address correspondence to:

Sandraluz Lara-Cinisomo, PhD
 Department of Kinesiology & Community Health
 University of Illinois at Urbana-Champaign
 1206 S. Fourth Street
 Champaign, IL 61820

E-mail: laracini@illinois.edu