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## Birth Order Effects on Breastfeeding Self-Efficacy, Parent Report of Problematic Feeding and Infant Feeding Abilities

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### Abstract

The goal of this prospective study was to identify effects of birth order on breastfeeding self-efficacy, parental-report of infant feeding behaviors, infant non-nutritive sucking and oral feeding skills in full-term infants at 3-months. Mothers were separated into primipara and multipara groups, and infants were grouped into siblings and no siblings groups. Parents completed the Breastfeeding Self-Efficacy Scale-Short Form, and Neonatal Eating Assessment Tool–Breastfeeding and Bottle-feeding scales. Non-nutritive sucking was assessed using a custom research pacifier and researchers completed the Oral Feeding Skills scale to assess feeding performance. Fifty-six mother-infant dyads (55% male) were included. Primipara mothers reported significantly lower breastfeeding self-efficacy and more feeding problems across breast and bottle-feeds on the Neonatal Eating Assessment Tool. There were no significant differences in non-nutritive sucking or oral feeding skills between infant groups. First-time mothers require more infant feeding support as they exhibited lower breastfeeding self-efficacy and reported more problematic feeding behaviors.

### Keywords

Birth order; self-efficacy; Non-Nutritive Sucking; Oral Feeding Skills; Neonatal Eating Assessment Tool; Breastfeeding; Bottle-Feeding

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#### Declaration of Interest

The Authors declare that Emily Zimmerman and Morgan Hines are employees at Northeastern University, and Alaina Martens is a doctoral candidate at Northeastern University.

#### Ethical Statement

The study design and procedures were approved by Institutional Review Board at Northeastern University (IRB #17-08-19).

## INTRODUCTION

The American Academy of Pediatrics currently recommends infants be exclusively breastfed for approximately 6 months (“Breastfeeding and the use of human milk,” 2012). However, in 2017, only 25.60% of infants were exclusively fed human milk through six months of age (Centers for Disease Control and Prevention, 2020). Health advantages of breastfeeding on short and long-term health and neurodevelopment in infants are documented and well understood (“Effect of breastfeeding on infant and child mortality due to infectious diseases in less developed countries: a pooled analysis. WHO Collaborative Study Team on the Role of Breastfeeding on the Prevention of Infant Mortality,” 2000; Kramer & Kakuma, 2004; Victora et al., 2016; Winberg, 2005). Literature suggests human milk decreases the incidence and/or severity of various communicable and non-communicable diseases (“Breastfeeding and the Use of Human Milk,” 2005), not only providing optimal nutrients to infants (“Breastfeeding and the use of human milk,” 2012), but also opportunities for mother-infant bonding. Further, breastfeeding decisions are multifactorial. Factors that may influence whether a mother initiates, sustains, or terminates breastfeeding range from demographic (e.g., race, age, marital status, education, socioeconomics) to biological (e.g., insufficient milk supply, infant health problems, and maternal obesity) (Thulier & Mercer, 2009). Considerations surrounding breastfeeding may also be psychological, relating to maternal confidence or body image (Rodgers et al., 2018; Zimmerman et al., 2018). Several previous studies have examined breastfeeding self-efficacy in mothers with more than one child and prior breastfeeding experience, finding birth order important (Kronborg & Vaeth, 2004; Yang et al., 2016). For example, Yang, Gao, Ip, and Sally Chan (2016) found previous experience influential in breastfeeding self-efficacy (Yang et al., 2016), while Kronborg and Vaeth (2004) found mothers with high breastfeeding self-efficacy and previous experience, exclusively breastfed their child for longer durations (Kronborg & Vaeth, 2004). While these studies showed experience breastfeeding prior children increased self-efficacy, they examined it soon after birth or across long time-ranges and did not examine the extent to which prior experience influenced parental report of problematic feeding nor actual infant feeding abilities.

Though breastfeeding is recognized as the optimal nutrition mode, most infants receive at least some formula via bottle-feeds within the first year of life (Bolling et al., 2007). The majority of research surrounding bottle-feeding focuses on reasons for breastfeeding cessation in an effort to develop interventions that promote breastfeeding (Van Esterik, 2002) with very little research on maternal bottle-feeding experiences. Lakshman, Ogilvie and Ong (2009) found women reported receiving inadequate information regarding bottle-feeding from healthcare professionals, resulting in feelings of uncertainty (Lakshman et al., 2009). More specifically, mothers reported not receiving instruction on formula use, bottle preparation or how to bottle-feed, which resulted in mothers making frequent changes to formula brand and type for their infant due to concerns about infant feeding behaviors (Lakshman et al., 2009). Thus, understanding the constellation of factors surrounding breastfeeding, bottle-feeding and infant feeding outcomes is essential.

A factor likely affecting both breast and bottle-feeding practices is birth order. Several studies suggest children with earlier birth order are more likely to be breastfed (Broad &

Duganzich, 1983; Buckles & Kolka, 2014; Der et al., 2006). Further, for bottle-feeding, Gottfried, Seay, and Wismar (1987) reported mothers are likely to position their first-born child differently during a bottle-feed compared to infants with higher birth orders (Gottfried et al., 1987). First-time mothers are also more likely to encourage bottle-emptying during feeding (Ventura et al., 2017). However, mothers with more than one child self-reported experiencing more distractions when feeding their infant (Golen & Ventura, 2015). Across these feeding modalities, mothers often keep the same feeding mode they chose for the first child for subsequent children. It has been reported that 70% of mothers with multiple children make the same feeding choice for each child (Taylor et al., 2008). Taken together, while feeding modality tends to be consistent across birth order, practices surrounding feeding are different.

It is critical to understand the role birth order plays in relation to breastfeeding self-efficacy while examining perception of infant breast and bottle-feeding abilities in parallel with physiological measures. Moreover, with other studies focusing mainly on the period just after birth, there is poor understanding of how these factors relate when a routine has been established postpartum, the infant is becoming more self-regulated (Chatoor et al., 1984) and solid foods have not yet been introduced. Therefore, the goals of this study were to examine the relation between birth order and breastfeeding self-efficacy, parental report of infant breast and bottle-feeding abilities, and physiologic sucking and feeding measures at 3 months of age. We hypothesized high birth order (≥ 1 sibling) would be associated with higher breastfeeding self-efficacy and fewer reported perceived problematic feeding behaviors. We did not predict any significant correlations for physiological measures of non-nutritive suck (NNS) and oral feeding skills across birth order.

## METHODS

Participants were taken from a larger study of sucking, feeding and vocal development in the first year of life (N = 86). This study was approved by the institutional review board at “X”. Full-term infants at 3 months of age were recruited from flyer distribution, Facebook groups, and word of mouth. Researchers arrived at homes approximately one hour before the infant’s scheduled feed, as determined by the caregiver. Parents provided informed written consent for themselves and their infants to participate. Researchers collected a NNS sample before observing a bottle feed while the researchers completed the OFS scale. Following the study, mothers completed the BSES-SF and the NeoEAT–Bottle and/or Breastfeeding scales. Participants received a gift-card for participating. Included infants were reported as healthy at the time of the study. Infants were excluded if they were born preterm, had chromosomal or congenital anomalies or did not have at least one bottle and one breastfeeding related measure.

### Measurement

**breastfeeding self-efficacy.**—Breastfeeding self-efficacy was assessed using the BSES-SF (Dennis, 2003). The BSES-SF contains 14 items and is a self-assessment questionnaire examining mothers’ confidence surrounding breastfeeding on a 5-point scale ranging from 1 (*not at all confident*) to 5 (*completely confident*). Ratings for each question were summed to

create a composite score, with higher scores indicating higher breastfeeding self-efficacy. In the current study, internal consistency was 0.95.

**parental report of infant feeding abilities.**—Infant feeding abilities were assessed using the NeoEAT–Bottle-feeding and NeoEAT–Breastfeeding (Pados et al., 2017), validated parent-report tools used to examine problematic eating behaviors in infants less than 7 months of age across bottle-feeding and breastfeeding, respectively. Mothers completed NeoEAT–Breastfeeding and/or NeoEAT–Bottle-feeding scales, which have 62 and 64 items, respectively. Reliability and validity of these scales has been demonstrated previously (Pados et al., 2017). Domains of the NeoEAT–Bottle-feeding scale include Infant Regulation, Energy & Physiologic Stability, Gastrointestinal Tract Function, Sensory Responsiveness, and Compelling Symptoms of Problematic Feeding. Domains of the NeoEAT–Breastfeeding scale include Infant Regulation, Energy & Physiologic Stability, Oro-Pharyngo-Esophageal Function, Gastroesophageal Function, Gastrointestinal Function, Feeding Efficiency & Sensory Responsiveness, and Compelling Symptoms of Problematic Feeding. In the present study, the NeoEAT–Bottle-feeding and NeoEAT–Breastfeeding were largely utilized as screeners as infants in our cohort were full-term with few problematic feeding behaviors. Given their use as screeners, we have not included internal reliability.

**non-nutritive suck.**—NNS was assessed using our lab’s custom device which includes a Soothie pacifier (Philips Avent) attached to a handle, connected to a pressure transducer that transmits information to a data acquisition system (Power Lab, ADInstruments) connected to a laptop with LabChart software (ADInstruments). Calibration was completed before every session. Infants were offered the pacifier for approximately five minutes. After the visit concluded, all data were analyzed using LabChart software. Trained researchers manually selected NNS bursts using the following criteria: bursts must contain two or more suck cycles, each suck cycle’s amplitude must be over 1 cmH<sub>2</sub>O, and a cycle is considered a new burst if there is a break of 1,000 milliseconds or more between cycles. These criteria are the same as previous studies examining NNS in young infants (Barlow et al., 2012; Estep et al., 2008; Poore et al., 2008). Once NNS bursts were manually selected for each suck sample, they were entered into a custom NNS Burst Macro, which allows for processing of burst variables: duration, amplitude, cycles/burst, frequency, cycles, and bursts. Next, the best two minutes of NNS data were selected based on cycle number, and minute rate averages were attained from the two-minute sample.

**oral feeding skills.**—Oral feeding skills were assessed using the OFS scale (Lau & Smith, 2011) which allows for a quantitative measure of an infant’s feed. The OFS scale was completed while observing caregivers bottle-feed their infant. During observation, a researcher denoted total volume offered in the bottle, volume taken during the first five minutes of feeding, total volume taken during feeding and feed duration. Using measures collected, the following outcomes were computed: initial volume (mL); transfer volume, (% volume taken/total volume prescribed); proficiency (% volume taken during the first 5 minutes/total volume prescribed); and transfer rate (mL/minute).

## Data Analysis

Given the non-normal distribution of the dependent measures, non-parametric Mann Whitney U tests were conducted. Statistical significance ( $p < .05$ ) was reported, effect sizes were interpreted such that coefficients between .10 and .29 represent a small association, coefficients between .30 and .49 represent a medium association, and coefficients of .50 and above represent a large association or relationship (Cohen, 1992). Effect sizes were utilized to interpret results and support our findings given our sample size.

## RESULTS

Fifty-six full-term mother-infant dyads (55% male), with an average birth weight of 3.48 kilograms (kg) ( $SD = .43$ ), range 2.49–4.65 were included. Mothers were on average 33.59 years old ( $SD = 3.16$ ), range 28.00–44.00, with infants aged 3.06 months ( $SD = .29$ ), range 2.56–3.76 or 92.97 days ( $SD = 8.93$ ), range 77.83–114.25. Specifically, average age for infants at the visit was 3.06 ( $SD = .30$ ), range 2.56–3.76 months in the siblings group, and 3.06 ( $SD = .29$ ), range 2.63–3.69 months in the no siblings group. Average birth weight was 3.59 ( $SD = .42$ ), range 2.95–4.65 kg and 3.34 ( $SD = .42$ ), range 2.49–4.11 kg in the siblings and no siblings groups, respectively. Gestational age in the siblings group was 39.20 ( $SD = 1.18$ ), range 37.00–41.00 weeks and 39.34 ( $SD = 1.11$ ), range 37.00–41.00 weeks in the no siblings group. Maternal age was 34.63 ( $SD = 2.92$ ), range 29.00–42.00 years and 32.21 ( $SD = 2.99$ ), range 28.00–44.00 years in the siblings and no siblings groups, respectively. Chi-squared and Fisher exact tests were used to compare the siblings and no siblings groups' demographics. Only maternal age was significantly different between groups ( $p = 0.004$ ). Table 1 includes more participant information statistics across groups.

### Breastfeeding Self-Efficacy Scale - Short Form

A Mann-Whitney U test showed a significant difference ( $U = 558$ ,  $p = 0.001$ ) between BSES-SF scores for multipara mothers compared to primipara mothers. The median BSES-SF score for multipara mothers was 66.50 (range 37–70) compared to 56.00 (range 20–70) for primipara mothers, suggesting multipara mothers have more breastfeeding self-efficacy. The effect size was .438, which is a moderate effect size.

### Neonatal Eating Assessment Tool–Breastfeeding Scale

A Mann-Whitney U test showed a significant difference ( $U = 109.50$ ,  $p < 0.001$ ) between NeoEAT–Breastfeeding Energy & Physiologic Stability scores for multipara mothers compared to primipara mothers. The median score for multipara mothers was 7.50 (range 1.00–16.00) compared to 15.00 (range 7.00–23.00) for primipara mothers, yielding a large effect size of .58. Considering a higher score on the NeoEAT indicates worse function, multipara mothers reported fewer energy and physiologic stability issues during breastfeeding.

A Mann-Whitney U test showed a significant difference ( $U = 177$ ,  $p = 0.002$ ) between NeoEAT–Breastfeeding Oro-Pharyngo-Esophageal Function scores for multipara mothers (median 9.50, range 1.00–22.43) compared to primipara mothers (median 14.00, range 4.00–29.00). There was a moderate effect size of .415.

A Mann-Whitney U test showed a significant difference ( $U = 211.50, p = 0.024$ ) between NeoEAT–Breastfeeding Gastrointestinal Function scores for multipara mothers compared to primipara mothers. The median Gastrointestinal score for multipara mothers was 7.00 (range 00–17.00) compared to 8.00 (range 3.00–17.00) for primipara mothers with a moderate effect size (.31). Multipara mothers reported their infants had fewer gastrointestinal issues during breastfeeding.

A Mann-Whitney U test showed a significant difference ( $U = 139, p = 0.001$ ) between NeoEAT–Breastfeeding Total scores for multipara mothers compared to primipara mothers. The median total score for multipara mothers was 50.50 (range 21.00–97.43) compared to 73.50 (range 32.00–108.00) for primipara mothers. Multipara mothers reported less frequent breastfeeding issues overall than primipara mothers with a large effect size of .567.

### **Neonatal Eating Assessment Tool–Bottle-Feeding Scale**

A Mann-Whitney U test showed a significant difference ( $U = 141, p = 0.02$ ) between NeoEAT–Bottle-feeding Gastrointestinal Tract Function scores for multipara mothers compared to primipara mothers. The median Gastrointestinal score for multipara mothers was 25.50 (range 14.00–61.65) compared to 35.50 (range 8.00–52.00) for primipara mothers. Considering higher scores on the NeoEAT indicate worse function, multipara mothers reported their infants had fewer gastrointestinal issues during bottle feeding. There was a moderate effect size of .352. No other relationships were significant for subscales or NeoEAT-Bottle-Feeding Total scores across groups.

### **Non-Nutritive Suck and Oral Feeding Skills Scale**

Mann-Whitney U test comparisons were not significant for NNS and OFS scale measures across multipara and primipara mothers.

## **DISCUSSION**

This study aimed to determine the role birth order plays in maternal reports of breastfeeding self-efficacy and problematic feeding as well as infant NNS and oral feeding physiology. The results revealed greater levels of breastfeeding self-efficacy in multipara mothers, which is likely related to prior experience. This finding is not surprising as multipara mothers have previously developed a breastfeeding skillset; this prior experience allows them to initiate breastfeeding with subsequent children with increased comfort and confidence in their abilities. First-time mothers do not have previous experience and must learn to breastfeed with their first child. These findings are consistent with others in the literature linking breastfeeding self-efficacy to prior experience (Kronborg & Vaeth, 2004; Yang et al., 2016) and expand on these findings, revealing this is indeed the case at the 3-month time point when homeostasis and regular feeding patterns are attained.

Beyond breastfeeding self-efficacy, parents reported their perceptions of their infants' feeding abilities, which, to our knowledge, has not been examined in relation to birth order. The Breastfeeding Total Score of the NeoEAT was significantly higher among first-time mothers (higher scores indicate worse function) in comparison to mothers with more than one child, which is consistent with findings detailed above regarding the BSES-

SF results. First-time mothers tend to report more breastfeeding problems (Feenstra et al., 2018; Kronborg & Vaeth, 2004; Yang et al., 2016). These findings, taken together with decreased confidence levels among first-time mothers, may adversely influence their perception of their child's breastfeeding outcomes. They may also be more critical of their and their child's breastfeeding performance. Mothers who have older children and previous experience with breastfeeding have more knowledge about breastfeeding and may be less sensitive to perceived problematic feeding behaviors in their infants (Kronborg & Vaeth, 2004). They also have a basis for comparison with their previous children and have knowledge regarding the breastfeeding processes and what occurs during a typical feed.

Interestingly, first-time parents reported significantly more problematic breastfeeding behaviors, including Energy & Physiologic Stability, Oro-Pharyngo-Esophageal Function, and Gastrointestinal Function in their infant overall, compared to their counterparts who have more than one child. Moreover, first-time parents reported significantly more problematic bottle-feeding behaviors on the Gastrointestinal Tract Function section of the NeoEAT–Bottle-feeding scale. The NeoEAT–Breastfeeding Energy & Physiologic Stability subsection included questions such as “My baby gets exhausted during eating and is not able to finish,” and “My baby needs help latching onto the breast (for example, needs a nipple shield or positioning help).” This section may speak to the finding that first-time mothers are more likely to position their child poorly and their infants are less likely to latch successfully on the breast (Goyal et al., 2011). Mothers with more than one child are also more likely to have better breastfeeding techniques (Lau et al., 2016), which may be related to prior experience.

The NeoEAT–Breastfeeding Oro-Pharyngo-Esophageal Function subsection involved questions related to choking, coughing, and discomfort during feeds such as, “My child chokes or coughs during feeds,” “My child becomes stiff/rigid during or after eating,” “My child becomes upset during feeding (whines, cries, gets fussy).” The NeoEAT–Breastfeeding Gastrointestinal Function subsection included questions such as, “My baby is very gassy,” “My baby turns red in the face, may cry with stooling/pooping,” and “My baby has diarrhea.” The NeoEAT–Bottle-feeding Gastrointestinal Tract Function subsection referred to questions like “My baby spits up between feeds or seems uncomfortable during feeds.” It appears first-time parents may be overly anxious about oropharyngo-esophageal and gastrointestinal symptoms overall. This level of worry surrounding gastrointestinal issues is paralleled by an increase in medications to treat these issues. For instance, from 1999 to 2004, there was a sevenfold increase in the use of prescription medications to treat gastroesophageal reflux disease, or GERD, in infants younger than one (Barron et al., 2007; Nelson et al., 2009). First-time parents may be particularly concerned about their child experiencing symptoms, such as spitting up during feeds, whereas parents with older children may perceive these symptoms as part of the normal developmental course.

These results indicate first-time parents perceive more problematic breastfeeding behaviors in their infant than parents with more than one child. First-born children experience a period of exclusive parental investment and primipara mothers are more anxious about parenting (Kalomiris & Kiel, 2016). Specific to feeding, primipara mothers are frequently worried about insufficient food intake (Colin & Scott, 2002). Therefore, reports of more problematic

feeding behaviors may be related to first-time parents' increased anxiety surrounding feeding.

To our knowledge, this is the first time birth order has been examined in relation to infant NNS and oral feeding skills. There were no significant differences in NNS or oral feeding physiology for infants with siblings compared to infants without siblings. These findings indicate there are no physiological reasons for the differences between first and subsequent born children in our cohort. Rather, these changes are due to parental perception of and self-efficacy surrounding feeding. Prior work has shown differences in feeding duration in first-time mothers compared to mothers with multiple children and this was not specifically measured in our study (Bates et al., 1979; Kaley et al., 2012).

While infants in primipara and multipara groups had no differences in sucking and feeding physiology, mothers in the primipara group reported more problematic feeding behaviors than multipara mothers, demonstrating a clinical need to address concerns for first-time mothers who may have increased concerns surrounding problematic feeding behaviors or lack of self-efficacy during feedings. Overall, this study demonstrated the usefulness and continued need for comparing parent-reported feeding measures such as the BSES-SF and NeoEAT–Bottle-Feeding and NeoEAT–Breastfeeding to infant sucking and feeding physiology as this may enable clinicians to better understand a full image of the infant's feeding experience, including interpreting parent perceptions that may negatively impact feeding.

There are several limitations to consider with respect to this investigation. There may have been subjectivity within self-report questionnaires and parents/mothers may have interpreted questions differently. Additionally, the sample included was relatively homogenous and therefore our findings are likely not generalizable to socioeconomically or ethnically diverse mother-infant dyads who have increased barriers to breastfeeding. Despite relative homogeneity, mother groups were not comparable for factors such as maternal age. However, this finding was expected given mothers are older when they have subsequent children.

## CONCLUSION

Mothers who have older children had higher levels of confidence surrounding breastfeeding as well as perceived fewer problematic feeding behaviors in their children compared to first-time mothers with no differences evident in infants' non-nutritive sucking or oral feeding abilities. More specifically, first-time mothers reported more issues surrounding gastrointestinal issues during both bottle and breastfeeding and issues surrounding breastfeeding energy and physiologic stability and oro-pharyngo-esophageal function. Future studies should examine breastfeeding duration and these findings among various populations, such as those born preterm, and with a larger sample size through the first year of life.



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**Table 1**

Study Participants (N=56)

	Siblings (n=32)	No siblings (n=24)
<i>Infant characteristics</i>		
Male	18 (56.25%)	13 (54.17%)
Vaginal delivery	25 (78.13%)	18 (75.00%)
Birth complications	16 (50%)	10 (41.67%)
Birth assistance	4 (12.50%)	0
Medical conditions	7 (21.88%)	7 (29.17%)
GERD	1 (3.13%)	3 (12.50%)
Exclusively offered human milk	27 (84.38%)	12 (50.00%)
<i>Maternal characteristics</i>		
Maternal ethnicity	29 (90.63%) White	18 (75.00%) White
Married	31 (96.88%)	23 (95.83%)

Notes: Numbers are listed as number (%).

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