



EDITORIAL

Pacifier and bottle nipples: the targets for poor breastfeeding outcomes^{☆,☆☆}

Chupeta e mamadeira: Os alvos para os desfechos desfavoráveis da amamentação

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The act of feeding an infant is extremely complex. Feeding requires the infant to coordinate five cranial nerves, multiple spinal segments in the chest wall, and 30 pairs of muscles across several physiological systems (oral, pharyngeal, laryngeal, and respiratory).^{1,2} In addition, successful feeding is dependent on optimal infant state and positive caregiver interactions. Recently, Goldfield, Perez, and Engsteler described newborn feeding as a *complex dynamical system* given all the critical components it entails.³ This complex dynamic system is especially at play during the most challenging of the infant feeding tasks, breastfeeding.

Breastfeeding is considered the gold standard for infant feeding, as it provides ideal nutrition.^{4,5} In fact, the World Health Organization⁶ recommends exclusive breastfeeding from birth until six months of life. Given the many benefits for mother and baby afforded by breastfeeding, there have been several campaigns to increase breastfeeding rates in women. One such campaign was the "Breast is Best," which was designed to educate communities on the importance of breastfeeding; its signage has been widely advertised in doctor offices and across literature directed toward mothers. In response to this movement, many women reported feeling

overwhelmed by societal pressure to breastfeed, and even bullied when using a bottle with their infant. Recently, a non-profit was started, "Fed is Best," with the notion that a fed baby is a happy baby; its ultimate goal is to reduce insufficient feeding of exclusively breastfed newborns. Even with the increased focus on breastfeeding, it remains unclear to researchers, clinicians, and parents alike if and to what extent using an artificial nipple (pacifier or bottle nipple) negatively impacts breastfeeding outcomes and practices.

The article from Batista et al.⁷ is an original cross-sectional study addressing the association between pacifier use and bottle-feeding with unfavorable behaviors during breastfeeding. In that study, 427 mothers were given a questionnaire regarding their sociodemographic status, perinatal data, and information on artificial nipple usage (yes/no). Next, a breastfeeding session was observed by a single trained evaluator between the mother-infant dyad and rated using the B-R-E-A-S-T-Feeding Observation Form, which evaluates difficulties in position, baby's response, establishment of affective ties, breast anatomy, and sucking behaviors. Ratings on this scale are classified as good, fair, or poor. The majority of the enrolled infants (85.50%) were older than 28 days and 14.50% of the cohort was younger than 28 days at the time of the study. Inclusion criteria were full-term infants between 5 and 120 days of life. The study excluded infants who had craniofacial anomalies, congenital neuropathies, twin pregnancies, and mothers who were unable to breastfeed due to some disease or mammillary traumas that made suck impossible. The study found that infants who used pacifiers and/or bottles showed higher percentages of poor and fair breastfeeding behaviors. The

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increase in the number of unfavorable behaviors regarding position, affectivity, sucking behavior, and baby response were independently associated with pacifier and bottle use, while breast anatomy was independently associated only with bottle use. The authors suggest that the use of pacifiers and/or bottle nipples may be associated with unfavorable behaviors during breastfeeding.

The authors are commended on examining this much needed research question in a prospective nature and including previous artificial nipple exposures on their questionnaire. One piece of information that would provide some further insights would have been the frequency of the artificial nipple use. The authors collected this information as a categorical variable (yes/no), but did not examine how many times a day an infant was using a bottle or pacifier. This information could help to determine whether those who use these artificial nipples more often exhibit an increased in unfavorable behaviors during breastfeeding. In addition, observing multiple breastfeeding sessions or including another rater for the breastfeeding observation would have allowed for data on inter- and intra-rater reliability, as these observations are often relatively subjective. It would also be good to know if the trained observer was blinded to the pacifier/bottle usage questionnaire data.

While the Batista et al. article appropriately focused on a homogenous group of full-term infants and excluded those with chromosomal or congenital neuropathies, the authors did not ask families if their infant had experienced any feeding-swallowing difficulties. This would allow us to further understand the rationale behind the use of bottles and pacifiers. Put simply, are these tools the root cause or solution to a breastfeeding problem? Often parents and clinicians use pacifiers and bottles to provide support for breastfeeding or to help practice the skills needed for breastfeeding. A review from my lab⁸ showed that one of the major issues with studies examining artificial nipples and breastfeeding is determining causation. This review found emerging evidence supporting the notion of nipple confusion (defined as an infant's difficulty with or preference for one feeding mechanism over another after exposure to artificial nipples) as it related to bottle feeding, but found very little evidence as it related to pacifier use. The review concluded that there is insufficient data to determine whether bottles and pacifiers are causing the infant to refuse the breast or whether they are simply markers of other maternal/infant characteristics that are at play in the extremely complex dynamic task that is feeding. The majority of research examining this topic reports the correlation or association, not the causal relationship, and until that is explored the answer remains relatively unknown.

Because we know that feeding is extremely complex, there has been an array of other variables linked to breastfeeding outcomes beyond mother-infant physiology. For example, maternal body image and pre-pregnancy body mass index have been highly related to breastfeeding initiation, intention, and duration,^{9,10} further highlighting the complexity of feeding. Previous research has even found that the intention to breastfeed is determined before the child is born, and that this intention is associated with breastfeeding duration after birth.¹¹ This could potentially, among other variables, be related to the causality of poor breastfeeding.

While the blame for poor breastfeeding outcomes is often placed on the use of artificial nipples, it should be noted that pacifiers in particular provide many benefits to young infants. Pacifier use has been shown to enhance essential clinical outcomes such as growth, maturation, gastric motility, and state control.¹²⁻¹⁴ Non-nutritive suck on pacifier results in higher feeding performance scores,¹³ reduces the transition time to full oral feeding,¹⁵ has a positive effect on the initiation and duration of the first nutritive suck,¹⁶ results in infants who are ready for bottle feeds sooner,¹⁷ and results in infants who took their bottles faster.¹⁷ Beyond soothing a baby, pacifiers are essentially practice for the daunting task of feeding. While most of the aforementioned studies were performed on preterm infants who are at-risk for sucking and feeding delays, the positive outcomes may generalize to older infants as well.

Finally, it is important to note that research shows that healthy babies with no feeding issues are typically able to suck and feed on any pacifier, bottle nipple, or breast without an issue. Research from my lab has shown that while various pacifier properties (stiffness and nipple and base shape) result in different suck patterns, these diverse pacifier properties did not deter initiating suck, rather the suck pattern within a suck burst changed.¹⁸ This type of sensory modulation has also been shown in the feeding literature, where various bottle nipple flows do *not* significantly alter the rate of milk transfer for the infant (preterm/full-term),¹⁹⁻²¹ suggesting that infants are able to adapt their sucking rate and pressures as needed.¹⁹ The organization of sucking in the brainstem allows for the full-term healthy infant to adapt their sucking in response to the specific properties present in each of the pacifiers/bottles utilized. Results may be different in infants with a history of feeding difficulties, neurological impairments, and/or medical complications that may impair their sensory feedback to these brainstem mechanisms and therefore their ability to modulate their sucking and feeding.

In summary, feeding is complex and dynamic, and we must remember this as researchers and clinicians. It is multi-factorial and until we fully understand and study these groups prospectively, as Batista et al. have done, and across many maternal-infant factors, we will not understand causality. Until that happens, we should be mindful that changing clinical practice surrounding artificial nipple use – without knowing the full story – may reduce the ability for those infants, such as those born prematurely or those with feeding issues, to gain access to these tools or for the parents to feel ashamed when using them when needed to support full nutrition. While of course having all mothers breastfeed would be ideal, we know that breastfeeding is complicated for some dyads. It is clear that more prospective research is needed in this area. Researchers should continue to add artificial nipples as a variable of interest, so we can better understand the causality related to poor breastfeeding outcomes.

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Conflicts of interest

The author declares no conflicts of interest.

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