

ORIGINAL ARTICLE

Determinants of perceived insufficient milk among new mothers in León, Nicaragua

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Abstract

Breastfeeding has been shown to improve maternal and child health. In Nicaragua, the primary risk of death and disability-adjusted life years among children under 5 years of age is suboptimal breastfeeding. Although the Nicaraguan Ministry of Health promotes exclusive breastfeeding from within the first half hour through the first 6 months of life, less than a third of children in the country under 6 months of age are exclusively breastfed. As part of a larger, mixed-methods study, 21 semi-structured, in-depth interviews were conducted with new mothers recruited from three primary health centers between June and August 2015 in order to identify the social, cultural, and structural factors that contribute to infant feeding practices and the discrepancy between recommendations and practices among mothers who delivered at an urban public hospital in León, Nicaragua. Audio recordings were transcribed verbatim, and interview transcripts were coded and analyzed by a three-member team using a grounded theory approach. Findings highlight a widespread perception of insufficient milk among mothers that influenced early cessation of exclusive breastfeeding and other infant feeding practices. This perception stemmed from anxiety about meeting infant nutritional needs and infant satiety, anxiety about maternal nutrition, advice from and role modeling of family members about mixed feeding, and perceived infant feeding norms. Results suggest that support modeled after the 10 steps of the Baby-friendly Hospital Initiative as well as strengthened policy-level support are needed. Community interventions that address cultural and structural barriers to improve breastfeeding practices may also help to increase breastfeeding rates.

KEYWORDS

Baby-friendly hospital initiative, breastfeeding, breastfeeding promotion, breastfeeding support, perceived insufficient milk, qualitative methods

1 | INTRODUCTION

Breastfeeding can impact a wide range of maternal and child outcomes (Victora et al., 2016). Breastfeeding transmits important nutrients and growth factors and helps reduce morbidity due to diarrhea as well as the severity of respiratory infections in infants (WHO, 2014). Breastfeeding helps establish the microbiome, which helps regulate immunologic and metabolic responses, and may also bolster brain development and cognitive performance in the infant (Victora et al., 2016). In mothers, breastfeeding can help space births and has recently shown to be associated with lower rates of breast cancer, ovarian cancer, and Type II diabetes (Victora et al., 2016). It is estimated that near-universal breastfeeding worldwide could avert about 823,000

deaths in children as well as 20,000 maternal breast cancer deaths annually (Victora et al., 2016).

In Nicaragua, a lower middle-income Latin American country (The World Bank, 2016) with a population of almost six billion people (Central Intelligence Agency, 2016), suboptimal breastfeeding represents the primary risk of death as well as disability-adjusted life years among all children under 5 years of age (Institute for Health Metrics and Evaluation, 2010). Although the Nicaraguan Ministry of Health – Ministerio de Salud (MINSa) – recommends exclusive breastfeeding beginning within the first 30 minutes of life (Instituto Nacional de Estadísticas y Censos, 2001) and the World Health Organization (WHO) recommends exclusive breastfeeding through the first 6 months of life (WHO, 2016), less than one-third of infants

in Nicaragua are exclusively breastfed through the first 6 months of life (Instituto Nacional de Estadísticas y Censos, 2001). Further, even though MINSA passed legislation that encourages the promotion, protection, and support of breastfeeding practices across the country (MINSA and UNICEF, 1999), chronic infant malnutrition, often associated with suboptimal breastfeeding practices, represents one of Nicaragua's top health priorities (PATH, 2011).

Existing literature has highlighted biological, social, and cultural barriers to suboptimal breastfeeding practices (Leung & Sauve, 2005; Pérez-Escamilla, Curry, Minhas, Taylor, & Bradley, 2012; Segura-Millán, Dewey, & Pérez-Escamilla, 1994). Among these, perceived insufficient milk (PIM) – the maternal report of a shortage of breastmilk or a lack of breastmilk to “come out,” “come in,” or “come down,” thereby failing to satisfy the hunger or meet the nutritional needs of her infant – is well documented and represents a common reason why mothers throughout the world report interrupting exclusive breastfeeding or stopping breastfeeding completely (Scheper-Hughes, 1993; Segura-Millán et al., 1994). Though PIM in the literature is described as mothers' reports of insufficient breastmilk volume (Segura-Millán et al., 1994), in this study, we consider PIM to relate to any reason why mothers perceive their breastmilk to satiate or nourish their babies inadequately. In this paper, we focus on experiences of PIM among new mothers in Nicaragua, a country where, to our knowledge, PIM has not been examined.

We draw on in-depth interview data among mothers who gave birth at an urban public hospital in León, the second largest city in Nicaragua (Becker-Dreps, Zambrana, Reyes, Vilchez, & Weber, 2014). We examine the social, cultural, and structural determinants of PIM in this sample. Understanding these determinants among Nicaraguan mothers could aid in the development of interventions in Nicaragua – a diverse country whose population is comprised of various ethnic groups including mixed Amerindian and White (69%), White (17%), Black (9%), and Amerindian (5%; Central Intelligence Agency, 2016) – and in other settings where suboptimal breastfeeding associated with PIM exists.

2 | PARTICIPANTS AND METHODS

2.1 | Study design

We conducted a mixed-method study comprised of close-ended questionnaires and semi-structured interviews. In this paper, we focus our analysis on data from the 21 in-depth interviews – conducted

using an interview guide (Appendix) – that provided an opportunity to understand the nuanced context that surrounds perceptions of PIM in our sample.

2.2 | Participant recruitment and sampling

Participants were recruited from three primary health centers located in the west, southeast, and northwest districts of León. We conducted eight in-depth interviews at Health Center (HC) 1, seven interviews at HC 2, and six interviews at HC 3. We selected this sample size based on previous qualitative work on breastfeeding that identified this number of participants or fewer as sufficient for attaining thematic saturation (Andrew & Harvey, 2011; Entwistle, Kendall, & Mead, 2010; Hackett, Mukta, Jalal, & Sellen, 2012). Because no new themes emerged after conducting about 12 out of the 21 interviews, we achieved thematic saturation in our sample.

We approached new mothers in the waiting area of each primary HC who visited with babies who appeared to be 2 years of age or younger. Given our expectation that maternal mode of delivery might influence early breastfeeding experiences (Prior et al., 2012), we used purposive sampling to maximize variation across maternal mode of delivery such that about half of the sample gave birth vaginally and half gave birth via cesarean delivery. We describe participants' demographic characteristics in Table 1.

2.3 | Participant eligibility

Following the consent process, we requested that participants answer a series of questions to ensure their eligibility. In recruiting study participants, we considered the following inclusion criteria: mother being 16 years of age or older; mother not having experienced severe hemorrhaging during the birth or afterward; index child being 2 years of age or younger; index child having a birth weight of at least 2,500 grams; index child not having spent more than 3 days in the Neonatal Intensive Care Unit after birth; mother not having been diagnosed with HIV; and index child being born at the indicated hospital.

This study was approved by Yale University Human Subjects Committee at the Yale University Human Research Protection Program (IRB protocol #: 1502015302). The protocol was subsequently approved by the Faculty of Medical Sciences of the National Autonomous University of Nicaragua-León (UNAN-León).

Key Messages

- Family-based peer counseling interventions that emphasize education about onset of lactation and breastfeeding maintenance and exclusivity should consider structural and societal contexts surrounding perceived insufficient milk (PIM).
- To address PIM, countries should enforce the WHO Code for marketing of breastmilk substitutes, support the Baby-friendly Hospital Initiative process, and address the specific needs of breastfeeding mothers who are employed.
- Scaling-up of breastfeeding programs needs to address PIM through specific protection, promotion, and support strategies.
- Pre-service and in-service training on PIM prevention are needed for health care providers.

TABLE 1 Characteristics of in-depth interview study participants, León, Nicaragua (N = 21)

Characteristic	N
Average maternal age (years) (N = 20)	23.2
Maternal parity (N = 21)	
Primiparous	16
Average index child age (months) (N = 21)	8.7
Occupation (N = 20)	
Homemaker	10
Student	5
Other	5
Marital status (N = 20)	
Married	8
Coupled	7
Single	4
Separated	1
Educational level (N = 20)	
≤ Primary school	7
Secondary school	10
College/technical school	3
Residence (N = 20)	
Urban or peri-urban	12
Index child sex (N = 21)	
Male	11

2.4 | Data collection, management, and analysis

In the interviews, we asked participants about their birth experiences and infant feeding practices to identify contributors to their breastfeeding patterns. We pilot tested the in-depth interview guide with three mothers visiting health posts in León prior to official data collection at the HCs. After piloting, we modified the guide according to participant understanding of questions asked, flow of questions, and cultural context.

The first author conducted all the interviews between June and August 2015. We obtained verbal informed consent from each participant following a description of the purpose and design of the study. We also requested permission to audio record the in-depth interviews, which all participants granted. While no names or other personal identifiers were collected, demographic data were collected to ascertain whether the participants represented the population of largely low-income mothers in León. In-depth interviews were conducted either in a private office with a closed door or in a semi-private area outside each HC. For our study, in-depth interviews lasted between 25 and 45 min each. We compensated all study participants with the equivalent of USD \$2.00 in transportation expenses back home after their health center visit upon completion of the interview both during the pilot phase and the official data collection period.

A three-member team of native Spanish speakers transcribed the in-depth interviews verbatim. Though salient participant quotations

were translated into English, original transcripts were coded and analyzed in Spanish. All original audio recordings were compared to the transcripts by the first author to ensure accuracy.

We used a grounded theory approach to identify themes in the interviews. The first author and two research assistants open coded an initial sample of five transcripts, assigning labels to specific themes and sub-themes within the data to develop an initial list of codes. We used this list to generate a draft codebook, iteratively refining the codebook as we coded subsequent transcripts. Throughout this process, we discussed code definitions, identified key themes, and verified the codebook using a consensus methodology. We used the first version of the codebook to code the next three transcripts before modifying, merging, or combining codes in order to establish a final codebook. We used this final codebook to recode the first eight transcripts as needed and to code the rest of the transcripts. We then organized codes into categories. We organized the categories into themes that we then placed into a conceptual framework. This model laid the foundation for theory development. The first author coded and classified the transcripts using qualitative data computer software ATLAS.ti v 1.0.23.

3 | RESULTS

As 76.2% (16/21 participants) of the study sample described experiencing PIM, PIM emerged as a key determinant of suboptimal infant feeding practices, including the cessation of exclusive breastfeeding often during the first month postpartum. Either spontaneously or when asked during the interviews about motivations for introducing breastmilk substitutes or complementary foods or beverages, participants described a belief in experiencing a breastmilk “shortage,” that their breastmilk failed to “come down” or “come out” or that they were otherwise unable to satiate their baby with their breastmilk alone.

The interconnected and multi-layered determinants of PIM fell within the social, cultural, and structural domains. The determinants included direct determinants, such as mothers' anxiety about meeting their infants' nutritional needs and about infant satiety as well as anxiety about mothers' own nutrition. They also included less direct determinants, including advice from and role modeling of family members' infant feeding practices and maternal perceptions of infant feeding norms.

3.1 | Anxiety about meeting infant nutritional needs and infant satiety

Maternal anxiety about being unable to meet their infants' hunger and support their nutritional needs emerged as an important determinant of PIM. Mothers often reported that they had not anticipated an insufficient supply of breastmilk prior to the birth of their child. One participant reported, “As soon as my girl was born, my baby, I give the breast, but nothing came out. That was the great deception for me.” She later described the adverse psycho-emotional effects of PIM: “I did not feel capable of feeding my girl...I even cried because I felt unable to feed my daughter.” (Esperanza, 31 years old). Another mother echoed both the perception and associated anxiety related to PIM, indicating, “That was my objective: only giving the breast. But I tried one month, but the

shortage, I don't know, the shortage of milk...I feel like it did not come out enough." (Yoselín, 36 years old).

This lack of ability to breastfeed successfully led many participants to introduce breastmilk substitutes. One participant described anxiety about not being able to provide enough for her baby warranted her introducing formula into her baby's diet. "It made me sad because my milk was not sustaining [the baby]...I decided to give Nestogeno¹ at seeing that my own milk was not sustaining my little girl." (María, 21 years old).

In addition to a perception of and anxiety about the inability of their breastmilk to nourish their babies adequately, some mothers expressed concerns about the initial stages of breastmilk production where only small amounts of colostrum are produced. María stated,

I did not have much milk, so then, uh, and also for the baby the milk did not sustain her, it did not sustain her, it was like water, because I gave it to her and nothing sustained her. After the birth, for like one week, it came out like white, but crystal clear...

Like María, the great majority of mothers in our sample reported experiencing PIM within the first week after birth. However, timing of reports of PIM varied among participants; some described the occurrence of PIM well after the first week postpartum. Yoselín described her experience with PIM, detailing her 1-month-old child's malnourishment manifested by his dehydration:

ah, then, one month only I was giving him only breastmilk...but then there was a shortage, and then the boy became dehydrated, he suffered dehydration and the reason being the little liquid that the boy took in through the breasts, so then my husband and I opted to give him leche en bote.²

Regardless of the timing of reports of PIM, mothers often expressed PIM by relating a response to their infant crying. For many mothers, the impact of their baby's crying, leading to a fear of not being able to nourish their children, contributed to PIM: "Upon seeing that [my baby] was hungry and that nothing came out, then, at seeing him desperately crying, I also felt distressed, no. I did not know what to really do." (Martha, 25 years old).

Another participant communicated distress associated with not being able to nourish her baby after responding to her baby's cries:

[Breastmilk] didn't, well, come out of the breasts. And there I waited all night and nothing, and [the baby] sucked and sucked but nothing came out, and [the baby] was crying and crying. And there, well, [the hospital] prohibits that we give leche de bote³ to newborns. There in the hospital they prohibit this, and for me, nothing came out and I was, well, sad, worried, because, because well, I was tired." (Monica, 21 years old)

The same participant later described how a failure to satiate her baby with breastmilk combined with hospital policy that forbade

providing formula to newborns compelled her to offer formula once she left the hospital: "But upon arriving at home, I had to give her her pachita⁴ because only breastfeeding doesn't yet sustain her." (Monica, 21 years old).

3.2 | Anxiety about maternal nutrition

In addition to maternal concerns about adequately nourishing their children, mothers' concerns about their own nutritional status also seemed to contribute to PIM. A common belief among participants was that mothers themselves must be well nourished in order to yield enough breastmilk. Some mothers anticipated insufficiency and described behaviors to prevent it. Describing efforts during pregnancy to mitigate potential issues with breastmilk flow, one participant reported, "It also helps to drink enough water and enough liquids, because they say that breastmilk is made up of water." (Luisa, age n/a).

Participants also addressed PIM by consuming *tibio*, which, as one participant explained, is a cornmeal-based beverage sold in grocery stores or *pulperías* (convenience stores) as *Pinolillo*. In Nicaragua, women often drink the cornmeal, combined with boiling water and flavorings before and sometimes for a short period after birth, as it is believed to stimulate the production of breastmilk. In our sample, mothers who discussed drinking *tibio* believed that its prophylactic consumption helped them produce breastmilk. In this sense, the custom suppressed many mothers' anxiety about their own nutritional status and seemed to prevent PIM. As Luisa described,

So I drank tibio before giving birth to [my baby]. One month before having him I started drinking it so that milk would come out. Because there are women for whom it takes up to 3 days [for milk to come out], but for me, it took only 6 hours.

Another participant explained that after waiting for days for her milk to come down and not being allowed to feed formula in the interim due to hospital regulations, consuming the beverage allowed her to breastfeed:

[My mother and sisters] started to give me tibio, tibio, quite a lot, and, and then after about 3 days, [the milk] came down, but I was very distressed, but afterward I was lactating and I could feed [my baby]." (Monica, 21 years old)

3.3 | Advice and role modeling

Several participants described the influence of family on their infant feeding patterns. Family members often contributed to the perception that feeding breastmilk substitutes to infants is a normative practice that helps address PIM. After mothers brought their babies home and were able to at least attempt breastfeeding – which every mother in our sample did – they often referred to the influence of a family member, such as their mother, grandmother, or mother-in-law as a

¹Brand of infant formula

²Canned milk, referring to infant formula

³Canned milk, referring to infant formula

⁴Bottle, referring to infant formula

factor in deciding to introduce breastmilk substitutes or complementary foods and beverages. Referring to the feeding patterns of her daughter before she reached 6 months of age, one participant discussed advice she received: "Because to me, hardly any milk came out. And so [my grandmother] would tell me that breasts did not fill her, the girl would remain with more hunger, and so that is why I gave her *leche de polvo*.⁵" (Claudia, 18 y).

Some mothers heeded advice from family members that contradicted breastfeeding support from health care providers. In some instances, participants reported adhering to family advice that led to a failure of breastmilk to come out. After learning from a provider that breast massages can help stimulate breastmilk flow, one participant reported,

I had to do the massages to my breast so that the milk could come out. But the truth is, like my grandmother told me, 'that will not make milk come out. Do not try those massages.' And I did what she said. So, maybe for that reason, not much milk came out. (Simona, 23 y)

Other advice indirectly influenced PIM. Another mother described familial advice influencing her decision to introduce pureed fruits and vegetables, often described using the brand name *Gerber*, into the diet of her 3-month-old baby:

Well for me, one always requests the opinions of those who are older. So, they told me – well, my mother-in-law told me – 'Start giving a taste,' she told me. Because now that [my baby] is 3 and a half months old, [I should provide him] with fruit. So I started to let him taste...*Gerber*. (Sara, 21 y)

Finally, indirect family influences such as role modeling of non-exclusive breastfeeding seemed to contribute to PIM among our participants. One participant described mirroring the infant feeding practices of two family members when deciding when, how much, and what types of complementary foods to introduce into her baby's diet: "And my mother, my grandmother, I watched what they did. From 3 months I started at the lowest [quantity of food], now I'm increasing it, increasing the feeding...since 3 months, [I give the baby] light things [to eat]." (Karina, 23 y).

3.4 | Perceived infant feeding norms

Infant feeding norms surrounding beliefs about the provision of breastmilk substitutes also served as an indirect determinant of PIM in our data. In particular, the pervasiveness of formula seemed to contribute to the belief that it was an essential part of a baby's diet. For example, after discussing the inability of her breastmilk to satisfy her baby's hunger, one mother described feeding her newborn *Nestogeno* because she believed that it is brand of formula that is generally provided to newborns: "And so I told the father, if we should buy un bote de *leche*,⁶ it will be *Nestogeno*, because all children are given *Nestogeno*." (Gabriela, 18 years old).

⁵Powdered milk, referring to infant formula

⁶A can of milk, referring to infant formula

Regardless of whether mothers in our sample believed they had a sufficient supply of breastmilk, they often believed they must offer breastmilk substitutes to keep their babies full. Another participant who described having enough breastmilk upon giving birth but who discussed offering formula anyway in order to keep her baby full echoed the perceived norm associated with offering *Nestogeno* as a breastmilk substitute: "I am giving my baby *Nestogeno*, which is normally given to newborns." (Sofia-Helena, 25 years old).

Formula was not only widely available but was also seen as critical to achieving an ideal infant weight. One participant explained why she introduced formula into her baby's diet: "So that [my baby] would have a good weight. So that he is not overweight or underweight, and he does not gain or lose weight." (Luisa, age n/a).

Participants expressed a preference for larger babies, and this norm may also have contributed to the idea that breastmilk is not sufficient to nourish one's child. As one mother noted: "What I wanted was, like any real mother, is to see a child healthy, handsome, and beautiful. So this is what I wanted. So there was a time that my child was nice and fat...and he looked nice." (Lucía, 28 y).

4 | DISCUSSION

Our results show that participants expressed concern about having an insufficient supply of breastmilk, which was described as a breastmilk "shortage," milk not "coming out," or milk otherwise being not enough to sustain the nutritional needs of their babies. This perceived inability to nourish their children adequately was partly rooted in anxiety about infant nutritional status and infant satiety. Second, mothers revealed anxiety about their own nutrition and a belief in the need to be adequately nourished themselves in order to breastfeed successfully. Additional determinants including advice from family members about ways to address an insufficient milk supply also contributed to PIM, as did role modeling of family members by introducing breastmilk substitutes and complementary foods into their own babies' diets. Finally, participants expressed perceived infant feeding norms, including the belief that all babies receive breastmilk substitutes and require mixed feeding to achieve a healthy weight and optimal health.

Though determinants of PIM likely vary based on cultural context (Van Esterik, 1988), PIM has been described elsewhere as a barrier to breastfeeding (Dykes, 2002; Dykes & Williams, 1999; Hackett et al., 2012; Segura-Millán et al., 1994) and some studies have identified other, related determinants of PIM, such as delayed onset of lactation (Segura-Millán et al., 1994). While research suggests that only a small minority of mothers worldwide are physically unable to breastfeed (Neifert, 2001), because the majority of participants in our study reported PIM occurring upon the first few attempts to breastfeed, delayed lactogenesis II may serve as an important contributor to PIM in our study. It is possible that mothers in our study experiencing PIM as a consequence of delayed lactogenesis II increasingly began to produce less milk than they once could as a result of their PIM coping mechanisms. Mothers experiencing PIM as a result of delayed lactation onset or otherwise often responded to it by introducing breastmilk substitutes, thereby reducing breastfeeding frequency and reinforcing the idea that breastmilk alone is not enough to satiate their

babies. The physiological demand–supply mechanism inherent in breastfeeding that makes frequent suckling a key component of successful breastfeeding (Leung & Sauve, 2005) may help explain this phenomenon.

Other important features of successful breastfeeding include an understanding of lactogenesis. One mother described colostrum as an unfamiliar substance that she believed was incapable of fulfilling her baby's nutritional needs. In this way, our data suggest that because colostrum is released in small amounts, mothers may not identify the substance – which confers protective properties in the infant (Leung & Sauve, 2005) – as an adequate source of nourishment before mature breastmilk comes in.

Consistent with existing literature (Hackett et al., 2012), we found that many mothers in our study reported understanding the importance of breastfeeding and even exclusive breastfeeding despite several of them not breastfeeding for long as recommended or not breastfeeding exclusively. Such reports also resonate with existing ethnographic research in Brazil on infant feeding patterns among poor mothers, who reported comprehending the importance of breastfeeding for their infants' health, but for many of whom breastfeeding became impossible when faced with stigma due to leaking milk at work (Chin & Solomonik, 2009; Scheper-Hughes, 1993). This discrepancy between breastfeeding knowledge and practice suggests that structural factors may shape breastfeeding norms and PIM.

Participants described formula use as normative, which seemed to contribute to PIM. Their demonstrated knowledge of different types of breastmilk substitutes speaks to the influence of breastmilk substitute marketing on infant feeding practices and perhaps on PIM. Around the world, the global USD \$44.8 billion breastmilk substitutes sales in 2014 (Rollins et al., 2016) may reflect the influence of marketing of breastmilk substitutes on families. It is estimated that the widespread feeding of breastmilk substitutes plays a role in annual global economic losses of USD \$302 billion (Rollins et al., 2016).

Conflicting governmental ideologies may contribute to these losses. Although Nicaragua's regulatory agency and largest health services provider, MINSa, promotes exclusive breastfeeding practices (Instituto Nacional de Estadísticas y Censos, 2001), the Nicaraguan Social Security Institute (INSS), a governmental agency that provides health services to formal sector workers and covers about 10% of the country's population (PATH, 2011), provides breastmilk substitutes to its beneficiaries (Social Security Administration, 2011). The INSS thus incentivizes many mothers to provide formula, contradicting MINSa's recommendations and perhaps providing mixed signals to mothers.

Though this study offers insight into the experiences and beliefs of new mothers in Nicaragua, which help explain their infant feeding patterns, it has several limitations. First, we were not always able to determine whether participants reporting experiences of PIM were referring to insufficient volume or quality of breastmilk. However, based on the language mothers used to describe PIM, including having a breastmilk shortage, or milk not “coming out” or “coming down,” it is reasonable to assume that in most instances, mothers were referring to milk volume. Further research on understanding quantity versus quality perceptions

surrounding PIM is important to conduct as interventions addressing each of these concerns may differ. Social desirability bias represents a second limitation of our study, as it may have driven participants' reports of PIM or the introduction of breastmilk substitutes. Rather than discussing reasons for disliking the practice of breastfeeding or attributing a lack of breastfeeding or exclusive breastfeeding to breast or nipple pain – which many mothers acknowledged yet ruled out as a reason for breastfeeding cessation – mothers may have found it more acceptable in the interviews to cite a physical inability to breastfeed rather than a choice to formula feed. Finally, a lack of data on prevalence of obesity and on body mass index – conditions that have been shown to influence women's milk supply early in the postpartum period (Lepe, Bacardi Gascon, Castaneda-Gonzalez, Perez Morales, & Jimenez Cruz, 2011) – in our sample represents a third limitation.

Despite its limitations, this study highlights novel information about the experiences of a population of mothers in Nicaragua. The widespread report of PIM suggests that interventions targeting lactation management are needed. First, mothers' understanding of infant crying should be addressed. Since PIM may partly stem from the way mothers perceive expression of infant hunger (Heinig, Banuelos, Goldbronn, & Kampp, 2009; Mayo Clinic, 2015), supporting women in identifying other infant needs besides hunger, which are manifested by the cue of infant crying, could help reduce PIM (Hackett et al., 2012). Second, programs focusing on educating mothers about infant growth spurts are needed to help mothers understand how much and how often to breastfeed. Next, interventions underscoring the fact that the most effective way to increase milk volume is by increasing nursing frequency and removing barriers that prevent breastfeeding on demand are needed. Finally, mothers should be made aware that even if their own nutrition is not optimal, they may still be able to produce enough milk to meet their infants' needs. For instance, average milk volumes of lactating mothers do not differ in developed and developing nations despite large differences in energy and nutrient intake (Institute of Medicine, 1991). This suggests that maternal anxiety and infant nursing behavior – including nursing frequency – are stronger predictors of milk volume than maternal nutritional status per se. Still, maternal reports of low breastmilk quality could indicate that education about maternal nutritional status and breastfeeding is needed to enhance breastfeeding self confidence.

Yet breastfeeding support in the form of education about lactogenesis and recommendations of optimal breastfeeding practices may be necessary but insufficient in order to address structural impediments to adherence to these practices. Both community-based interventions like peer counseling for breastfeeding and enabling interventions have been shown to increase rates of continued and exclusive breastfeeding (Rollins et al., 2016). The use of peer counselors, who often continue contact with their clients for weeks or months postpartum, has been shown to support mothers in achieving improved rates of breastfeeding duration, exclusivity, and initiation (Chapman, Morel, Anderson, Damio, & Pérez-Escamilla, 2010; Jolly et al., 2012; Wouk et al., 2016). Postpartum group peer counseling involving family members could help hospitals satisfy Step 10 of the Baby-friendly Hospital Initiative: to encourage breastfeeding support

groups post health facility discharge (Pérez-Escamilla, Martínez, & Segura-Pérez, 2016). Furthermore, mothers may be apt to follow infant feeding patterns independent of healthcare facility staff once they leave the hospital where support may be provided. Thus, emphasis on breastfeeding maintenance postpartum – also represented by a substantial strengthening of Step 10 of the Baby-friendly Hospital Initiative – to address barriers to breastfeeding that exist outside the health provision setting is urgently needed (Pérez-Escamilla et al., 2016, Bueno-Gutierrez & Chantry 2015). This may include providing family-based support and protection from the influence of breastmilk substitute marketing. Further, breastfeeding maintenance support may be especially important since participants in this study reported heeding infant feeding advice of family after leaving the hospital. Additionally, our findings indicate that prenatal anticipatory guidance on what to expect regarding colostrum and the onset of the lactation period is warranted. In Nicaragua, health care providers who provide breastfeeding support should do so in accordance with the Nicaraguan Family and Community Health Model, whose aims are to strengthen health services and improve health equity and patient satisfaction by providing comprehensive care (Muiser, Saenz Mdel, & Bermudez, 2011).

Research suggests that breastfeeding promotion strategies can be scaled up by integrating them into existing maternal and child health interventions like infant growth monitoring, immunization, or family planning programming (Pérez-Escamilla et al., 2012). Support for breastfeeding maintenance, including direct breastfeeding consultations, parental leave for breastfeeding mothers, and prevention of unethical marketing of breastmilk substitutes – perhaps via stronger implementation of the International Code of Marketing of Breastmilk Substitutes (WHO, 1981) – can help improve healthy maternal behaviors like continued and exclusive breastfeeding. Implementation of these interventions can help global society meet the World Health Assembly Global Nutrition Target 2025 for breastfeeding (WHO, 2014). It is important to understand how these efforts specifically impact PIM and its determinants in Nicaragua and elsewhere.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

CONTRIBUTIONS

CS, RPE, WJUG, and EMEM developed the original study idea. CS wrote the study proposal with guidance from RPE. CS, DH, and SK received the grants needed to implement the study. CS collected the data; CS, DH, and SK analyzed the data. CS wrote the first draft of the paper with input from RPE and DK. Several drafts were developed with edits and improvements suggested by RPE, DK, WJUG, DH, SK, and EMEM. All authors have read and agreed to the final draft of the manuscript.

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APPENDIX

Appendix. Participant interview guide

Note: This document is meant to serve as a guide to the interviews. Depending on the information obtained from the respondents, the probes may change slightly; additionally, additional probes may be used. This document might include probes not listed here depending on what the respondent says. This interview guide is intended to lead the conversation on infant feeding practices among new mothers.

Interview date: _____.

Location of interview: _____.

Interviewer(s): _____.

Additional: _____.

Setting up the interview

1. Interviewer introduction
2. Explain voluntary nature of interview
3. Review the consent sheet, that interview will be audio-recorded, and obtain verbal consent
4. State reasons for conducting the interview
5. Ask the participant if she has any questions [START Audio-Recording]
6. Initiate the interview once she has provided verbal consent to proceed

Questions

1. What was it like for you the day your son/daughter was born?

Probe: Could you please describe the day your son/daughter was born?

Probe: Could you describe the labor?

2. Thinking back to when your baby was first born, what was it like feeding your baby?

Probe [for C-section mothers]: Can you describe how you were able to breastfeed?

Probe: Has the way you feed your baby changed at all since he or she was born?

Probe: What influenced your decision to feed your baby the way that you do now?

Probe (if applicable – if baby is old enough to be eating solid foods): Thinking back to before your baby started to eat solid foods, what was it like breastfeeding your baby?

Probe: Could you please describe any challenges you faced in feeding your baby?

Probe: What was the hardest part?

Probe: What were the worst things about feeding your baby?

Probe: Could you please describe anything that helped you feed your baby?

Probe: What was the most useful?

Probe: What were the best things about feeding your baby?

3. Before giving birth, how prepared did you feel to feed your infant?

Probe: Please talk about the way you ended up feeding your baby differ from the way you planned to feed your baby before you gave birth?

Probe (if applicable): How old was your baby when you first introduced solid foods?

4. What is it like feeding your baby now?

Probe: Could you please describe any challenges you currently face feeding your baby?

Probe: What is hardest part?

Probe: What are the worst things about feeding your baby?

Probe: Could you please describe anything that helps you feed your baby?

Probe: What is the most useful?

Probe: What are the best things about feeding your baby?

5. Thinking back to the plans you had for feeding your baby before he or she was born, how have you been able to follow the plans you had regarding feeding your baby?

6. Is there anything else you would like to share about your infant feeding practices?

Probe (if applicable): Did you experience any complications during your pregnancy? If so, how did they influence your infant feeding practices?

Demographics

- Age:
- Residence:
 - Rural or urban?
- Occupation:
- Education:
- Relationship/marital status:
- Maternal mode of delivery:
- Parity:
- Date of last birth:
- Sex of baby from last birth:

STOP Audio-Recording.

Thank interviewee for her time and for participation.

Provide compensation.