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Feeding and refusal of expressed and stored human (FRESH) milk study - a short communication

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Abstract

Breastfeeding initiation has been increasing to meet Healthy People 2020 goals. As breastfeeding initiation has increased, milk expression has increased. Consequently, storage of human milk has become more common. While it is reported anecdotally, there is no data available on the prevalence of infants refusing expressed, stored human milk. To fill this knowledge gap, a survey of lactating women indicates 25% of infants offered expressed, stored human milk refused to consume it. Almost one-third of respondents (29%) reported that the stored milk had an "odd" color. For the women reporting the refusal, 95% of those described an "off" smell to the milk with 13% reporting a bad taste. Women discarded the "off" milk when infants refused it. The women often discarded the remaining stored milk, with one woman reporting discarding almost 9 gallons of expressed, stored milk. Additional study is needed to understand how to prevent discarding of human milk.

Keywords: human milk, breast pumps, milk storage, breast milk spoilage, expressed milk

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Introduction

Breastfeeding is recognized as the best feeding method and as optimal food for infants as it contains all the nutrients that infants need to grow and develop. In the United States, there appears to be a strong desire to breastfeed, with 83.2% (more than 3 million per year) mother/infant dyads breastfeeding at least once shortly after the infants were born.[1] This number has exceeded the Healthy People 2020 guideline that challenged healthcare providers to better support breastfeeding initiation.[2] With increased awareness of the benefits of providing human milk to infants and the availability of breast pumps, mechanical expression has become more common. Researchers have reported that between 68% and 92% of breastfeeding women express their milk at some point during lactation.[3–5] A common reason cited for expressing milk was to store the milk for later use.[6,7] Women frequently use a breast pump to increase their milk supply[8] and to allow someone else to feed the infant expressed breastmilk.[4] Many women begin expressing their milk within the first few days postpartum.[8] As using expressed milk becomes increasingly more common, so too, in clinical practice are the anecdotes regarding infants who are refusing to drink the expressed, stored milk. There is a gap in the literature of this event. The purpose of this study was to document the prevalence of infant refusal of expressed, stored human milk and identify any association with how the milk was expressed and how the milk was stored.

Methods

Women who visited the Foundation for Maternal, Infant, and Lactation Knowledge breastfeeding networking groups, either in person or online, were invited to participate in a survey on the Feeding and Refusal of Expressed, Stored Human Milk, or the FRESH Milk project. Any woman providing their email contact information was sent a link to an online anonymous survey that was distributed to 100 women via email. The questionnaire asked about expressing milk, about storage of the milk, and any experience with infant refusal of the expressed milk. Additionally, mothers were asked if they had personally noted a different smell or taste to the milk which the infants had refused.

Results

Of the 100 surveys sent out, 84 of the surveys were completed and returned. The majority of the respondents, 89.3%, were breastfeeding at the time they completed the survey. Many, 65%, were expressing their milk regularly when they responded to the survey. All the women surveyed reported that they had fed their infants directly from the breast for more than 4 months. They also reported that they expressed their milk at least one time during their lactation, and commonly several times each day. Most of the respondents did store their milk (87%) for longer than 1week. There were 13% of the respondents directly breastfeeding at the time of the survey rather than providing expressed milk via bottles although they were expressing their milk and storing for future use. Almost half (40%) of the respondents reported that they stored their milk every day. The majority (73%) of the respondents stored their milk frozen with 27% storing their milk in the refrigerator. A refrigerator-freezer was used by 78% of those freezing their milk, and 22% used a chest-type freezer. Most respondents used (71%) plastic storage bags to store the milk, while 13% used plastic bottles, and 2% stored the milk in glass containers.

Almost half of the participants (46%) stored their milk for longer than 1 month. Over one third (38%) of respondents stored the milk in containers of 4 ounces or larger. Based on the responses to the survey, 24.6% of all infants had a least one occasion of refusing to eat the milk that had been stored. An abnormal smell was noted by 25% of all the respondents, and an abnormal color was reported by 29%. By report, the abnormal color did not prevent the infants from accepting the milk. However, for the respondents that reported an "off" smell in the milk, 95% of their infants refused the milk. An abnormal taste was voluntarily recorded by 13% of the respondents in the milk that was refused by their infants.

The respondents that reported they experienced "off" milk either by smell or taste were asked if they knew the cause of the "off" smell or taste and how to correct it. There was no consensus on why the milk had become "off" nor how to correct it. The respondents with "off" milk discarded the milk that the infants refused. Many of the women reported that they also discarded their stored milk if it smelled odd. The amount of expressed milk reported discarded by the respondents ranged from 4 ounces to 1114 ounces with the mean of discarded milk 18 ounces.

Conclusion

This assessment opens many doors to questions about what happens when human milk is stored and fed later as a reheated meal. While there is some information about stored milk, there is much more that needs to be explored. There appears to be a relationship between altered smell and acceptance of human milk as food as it was reported by the respondents that almost all of the milk that smelled "off" was refused by the infants. The cause of this "off" smell is unknown for human milk. The dairy industry has comprehensive descriptors for "off" smell in dairy milk which include causes of changes in odor.[9] It is known that some components of human milk are changed during storage. Although the energy content does not change significantly, it has been reported that the protein and carbohydrate in human milk do increase while the lipid content increases with storage depending on the material composition of the storage container.[10] One study found that the pH of frozen milk goes down and non-esterified fatty acids concentration appears to increase.[11]

Many nutrients in human milk are susceptible to heat, light, and oxygen degradation. Vitamin B2, (riboflavin) and vitamin C (ascorbic acid) are highly susceptible to oxidation.[12,13] Riboflavin and vitamin A content in human milk was reduced by exposuren to fluorescent lighting.[14] Even a short amount of time exposed to air and light can cause decreases in specific nutrients such as retinol and alpha-tocopherol, which could adversely affect the taste of the milk.[15] It is unknown if these changes in the nutrient composition correspond with negative changes in smell or flavor of human milk. It is known that some foods can "flavor" human milk but these flavors are not considered negative by the infant. For example, it is known that a woman consuming garlic has milk with a garlic aroma.[16]

Infants of these women consume a high volume of milk when their mothers eat garlic.[17] It has been reported that the flavors in human milk originating from a mother's food intake are transmitted to the infant, providing them with the opportunity to become accustomed to flavors of the foods available to them upon weaning from the maternal environment. [18] According to reports from the dairy industry, the degradation of certain nutrients does impact the flavour of animal milks.[19] The dairy industry has classified the adverse flavors and causes of the change in flavour of bovine milk. These are classified as "transmitted" (feed) off-flavours, and 9 (15%), 6 (10%), and 4 (6%) as "rancid", "oxidized" and "malty" off-flavours, respectively.[20] While this may be a starting point of useful information, bovine digestion is completely different from that of human and this information is not generalizable to humans. While the participating sample size is small, and mothers regularly tasting their own milk is rare, these results give a sneak peek into infants' feeding habits and how human milk may be affected by storage. Women who express their milk expend physical and emotional energy to collect milk to provide this important food to their infants. It can be heartbreaking for women when their infant refusing to eat the milk they have provided. Better recommendations for handling and storing human milk are needed to ensure that the stored milk is acceptable to infants.

This study leaves room to research further the biochemical correlation to milk storage and infant refusal. Though there is some suggestion this milk is souring or spoiling in some other way, extensive scientific analysis is needed to confirm our suspicions. It leaves many questions unanswered regarding causes of infant refusal of expressed human milk. While this study leaves questions, it draws attention to an important unexplored area in lactation. One limitation of this study is that it is not inclusive of all women expressing their milk for their infants. The respondents were self-selected. This study did not include any women solely feeding expressed human milk with no feeding directly from the breast. While this study is small, it draws attention to an important unexplored area in lactation. This leads to the question of how can this waste of human milk be prevented? Additional study needs to be done to evaluate the biochemical changes to milk related to storage and infant refusal.

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Conflict of interest

The authors have no conflict of interest.

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