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Barriers and Promoters of Home-Based Pasteurization of Breastmilk Among HIV-Infected Mothers in Greater Dar es Salaam, Tanzania

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Abstract

Background: For the past decade, heat-treating breastmilk has been an infant feeding option recommended by the World Health Organization as a strategy to reduce vertical transmission. However, little is known about field experiences with it. Our primary objective was to explore the barriers and promoters of the implementation of breastmilk pasteurization, "flash-heating" (FH), in the real-world setting of Dar es Salaam, Tanzania.
Subjects and Methods: Nineteen in-depth interviews were conducted with participants in a home-based infant feeding counseling intervention in which FH was promoted after 6 months of exclusive breastfeeding. Additionally, three focus group discussions were conducted with peer counselors. Interviews were transcribed, translated, and coded independently using NVivo 8 software (QSR International). Data were analyzed using the socioecological framework.
Results: Information and support provided by peer counselors were the most important promoters of initiation and continuation of FH; this impacted individual-, interpersonal-, and institutional-level promoters of success. Other promoters included perceived successful breastmilk expression, infant health after initiation of FH, and the inability to pay for replacement milks. Stigma was the most important barrier and cut across all levels of the framework. Other barriers included doubt about the safety or importance of pasteurized breastmilk, difficulties with expressing milk (often attributed to poor diet), and competing responsibilities. The most common suggestion for improving the uptake and duration of FH was community education.
Conclusions: Given the acknowledged role of breastmilk pasteurization in the prevention of vertical transmission, further implementation research is needed. A multilevel intervention addressing barriers to FH would likely improve uptake.

Introduction

Heat-treating expressed breastmilk has been a World Health Organization-recommended infant feeding option in the context of maternal human immunodeficiency virus (HIV) for the past decade.[1,2] The 2010 World Health Organization guidelines recommend heat-treated breastmilk as an interim feeding strategy (e.g., during mastitis, when prophylactic antiretroviral drugs are unavailable, or to assist mothers to stop breastfeeding). The guidelines note that programmatic data are scarce; they and others have called for more research on the feasibility of implementing and sustaining heat treatment of breastmilk as a strategy to reduce postnatal vertical transmission.[2,3]

"Flash-heating" (FH), the most commonly described in-home breastmilk pasteurization technique, involves expressing breastmilk into a glass jar, which is then placed in a pan with water two finger-widths above the level of the milk.[4] The water is rapidly heated to a rolling boil, and then the milk is removed from the water and once cooled cup-fed to the

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infant. Milk should reach a peak temperature of approximately 72.0°C.[5] Bacteriologic, virologic, antimicrobial, immunologic, and nutritional studies under laboratory conditions have indicated that it can be a safe feeding method.[4–9] However, little is known about women's experiences with breastmilk pasteurization. The primary objective of this study was to describe experiences with FH and identify the barriers and promoters of initiation and continuation of FH in a real-world setting.

Subjects and Methods

Subjects and clinical study design

Data were collected of the feasibility of FH in the context of a clinical study (registered at http://ClinicalTrials.gov) from March 2008 until August 2009; study details have been described elsewhere.[10] In brief, 101 HIV-infected and 43 uninfected women resident in greater Dar es Salaam, Tanzania who were breastfeeding infants between 6 weeks and 3 months were enrolled. The research was described as an infant feeding study entailing weekly home visits by community health workers and monthly visits to the clinic.

Peer counseling intervention

Home-based infant feeding counseling was provided to mothers (and other interested household members with maternal permission) by peer counselors (11 females and one male) who had experience as breastfeeding counselors but no biomedical training. They were provided with a 1-week course on HIV and infant feeding training, based on the then World Health Organization[11] and Tanzanian[12] recommendations, training on FH, and periodic "refresher" sessions.

In the first months of the infants' lives, peer counselors emphasized the importance of exclusive breastfeeding to 6 months and demonstrated how to manually express breastmilk, using dialogue and illustrated pamphlets. Although peer counselors were to visit mothers weekly, visits occurred approximately biweekly.[10]

When infants reached 4 months of age, counselors provided information about complementary feeding, including FH (see Supplementary Fig. S1; Supplementary Data are available online at www.liebertonline.com/bfm). Participants were considered eligible for counseling on FH if they were breastfeeding an infant documented to be HIV-negative at 5 months; HIV tests were offered as part of the study. Women were counseled to begin FH prior to the introduction of complementary foods (in order to avoid mixed feeds [non–exclusive breastfeeding]). They were also counseled to heat their milk after each expression, to express as frequently as possible, and to continue FH for as long as possible. Participants were given a plastic bucket, an aluminum pan, a glass jar, and a graduated plastic feeding cup. Counselors continued home visits for 3 months after FH was initiated or until the mother ceased FH, whichever came first. Once FH began, FH mothers received a mean of 5.3 peer counselor visits.[10]

Qualitative data collection and analysis

Nineteen in-depth interviews were conducted from November 2008 to February 2009: 17 with mothers who had attempted FH and two with those who opted not to. Interviews were conducted in Swahili by a Tanzanian researcher (S.L.) not associated with prior study activities. Interviews were conducted in a private room either at the clinic or at the participant's home, per their preference, while they were still using FH or within 2 weeks of cessation. Interviews continued until saturation was determined.[13] Topics covered included manual expression, heating, and cup feeding of breastmilk, experiences with peer counselors, social support, stigma, and perceived health consequences of FH. Interviews were transcribed, translated into English, and coded independently using NVivo 8 software (QSR International) by two of the authors (C.A. and J.S.). Discrepancies between codes were identified and discussed until resolution was reached.

Two focus group discussions (FGDs) were held with peer counselors (conducted by S.L.) while the study was in progress. In May 2011, a final FGD was conducted (by S.L. and S.Y.) with two study participants who had flash-heated and two peer counselors.

Theoretical perspective

In order to assess the multiple levels of influence regarding the decisions to initiate and continue FH, we examined data using the socioecological framework.[14–16] In brief, this theoretical approach to understanding health behaviors assesses five levels of influence on a given behavior:

1. Individual characteristics (e.g., physical attributes, beliefs, and knowledge)
2. Interpersonal relationships (e.g., attitudes and resources available through family and friends)
3. Institutional influences (e.g., impact of study intervention, clinical care)
4. Community attitudes (e.g., attitudes about infant feeding)
5. Social structure and policies (e.g., national infant feeding policy)

Although the socioecological framework necessarily presents the levels as distinct, in reality they are fluid. For example, peer counselors were part of an institution (Level 3) but many developed interpersonal relationships with mothers (Level 2). However, as a heuristic tool, it is useful for identifying barriers and promoters at multiple levels.

Ethics

The study was approved by Institutional Review Boards at the National Institute of Medical Research, Muhimbili University of Health and Allied Sciences in Tanzania, and the University of California Davis. Written informed consent was obtained from all participants in the intervention; verbal consent was obtained for interviews and FGDs.

Results

Study-wide FH behavior

In-depth results about FH uptake and behaviors have been presented elsewhere.[10] In brief, a substantial proportion (51.4%) of the 72 HIV-infected mothers whose infants tested HIV-negative at 5 months were willing to try FH. An increasing proportion of eligible mothers chose FH as the study progressed (i.e., 38.8% enrolled in the first 6 months of the study attempted FH vs. 78.2% of women enrolled in the subsequent 7 months). The median frequency of milk expression was three times daily, and duration of FH during

study follow-up was 9.7 (0.1–15.6 weeks); at least four women continued FH after the study ended. Mean (SD) daily milk volume was 322 (201) mL (range, 25–1,120 mL), which constitutes approximately 34% of caloric needs for an average 6-month-old infant,[17] and increased by two to threefold the mean amount of animal source foods otherwise received.

The FH process: breastmilk expression, heating, and cup feeding

Three women spontaneously mentioned that they felt that manual expression yielded sufficient milk: "I get milk very well…I am going on well, there is no problem at all" (FH19) (Table 1). Some women were concerned by the diurnal variability in their milk production: "During the afternoon and evening I get a small amount of milk because in the morning I express a large amount" (FH06). Another mother had similar issues: "It depends on time. If you sleep, on waking up milk flows easily […] but in the afternoon […] the flow of milk isn't good and it decreases" (FH10).

Breastmilk expression was the most challenging part of the FH process. Four women found manual expression of a sufficient quantity of milk to be challenging, sometimes leading to discontinuation: "It is very difficult…sometimes I don't get enough milk to satisfy the baby" (FH07). The low quantities of expressed breastmilk were overwhelmingly attributed to women's poor nutritional intake; seven women mentioned how their diet was responsible for what they deemed as insufficient milk for their infants: "After the farming work, I am very tired and have eaten nothing so I cannot produce milk. I have learned that I have to eat more often in order to produce enough milk" (FH08). Many respondents could not afford an improved diet, which was troubling to both the mothers and the counselors; as one counselor explained, "We feel pain" (FGD1X).

Problems with maternal health impeding breastmilk expression, including breast health, sometimes led to cessation of FH. One mother described how poor maternal health can cause cessation of FH: "If a woman is sick she will not be able to express milk; first she will not get milk and she will not have strength. And also she will not have time to express milk" (FH19). Even in good health, some women complained about the time required: "I could not do other things because of it; I started in the morning and it took me up to 11:00 AM and still it did not come" (FH15).

For the most part, heating the milk was straightforward, with only two noteworthy issues. Accurate duration of heating was an issue mentioned by four mothers: "I was worried I could not tell if I have warmed it excessively; it was even more problematic at night hours" (FH15). Three women spontaneously mentioned issues with fuel: "Sometimes the water takes a long time to boil because of not enough firewood. So I get very worried …" (FH08).

Cup feeding the baby seemed to be the easiest part of FH for mothers: "The part that is simple is giving milk to a baby" (FH06), and "It is easy to know whether your baby is satisfied or not because you have a certain measurement" (FH04).

Table 1. Overview of Promoters and Barriers to Flash-Heating, by Level of Influence

Level, characteristic	*Promoters*[a]	*Barriers*[a]
1. Individual		
• Maternal beliefs and knowledge	Belief that heated milk would be HIV-free Belief in importance of breastmilk after 6 months Sound understanding of FH procedures Ability to disguise purpose of peer counselor visit	Belief that FH could lead to disclosure of HIV status Doubt of safety of FH Disbelief of importance of breastmilk after 6 months Uncertainty about correct FH procedures Dislike of expression
• Maternal physical characteristics	Perceived adequate milk production Perceived adequate maternal nutritional intake	Poor maternal nutritional intake Inadequate milk production Poor general or breast health
• Infant health status	Good health of infant during FH	
2. Interpersonal		
• Attitudes of friends and family	Acceptance of FH by family, friends Support of FH by peer counselors Disclosure of HIV status	Hiding FH from family, friends, or neighbors Stigma of peer counselor home visits Fear of disclosure of HIV status
• Household resources	Inability to purchase replacement milks Adequate fuel Support with household chores	Competing responsibilities: other children, work outside of home Insufficient fuel
3. Institutional		
• Study intervention	Peer counselor home visits FH informational materials	Conflicting messages about breastfeeding from hospital staff and other authorities
4. Community		
• Community beliefs	Community education	Importance of breastfeeding at the breast Unfamiliarity with FH procedure Stigma of HIV
5. Social structure and policy		
• Information from authorities	WHO-supported policy	Conflicting messages about breastfeeding from hospital staff and other authorities

[a]Listed from most frequently to least frequently mentioned in interviews and focus group discussions.
FH, flash-heating; HIV, human immunodeficiency virus; WHO, World Health Organization.

Initiation of FH: promoters and barriers

Prevention of HIV transmission was the overwhelming motivation to attempt FH; 10 of the 17 mothers who used FH spontaneously described how they decided to use FH because they wanted to make their milk safe: "I am protecting my baby from getting infection" (FH03). Several mothers also mentioned how FH helped children to avoid malnutrition. Three women reported that they decided to FH because they could not afford other kinds of milks: "There is no money…that is why I found it is the only way which will help me" (FH02).

Others never fully believed in the efficaciousness of FH at preventing transmission: "Even though they are saying that if you Flash-heat it becomes safe, it is better to give a baby other foods. […] You are sure that you don't give the baby things which might lead her to get problems" (FH11). Another barrier was the perception that breastmilk was unnecessary after 6 months: "If a baby is already 6 months old and she is not infected, I don't see how it is necessary to continue breastfeeding a baby with mother's milk because I don't think it [breastmilk] is complete by itself. The baby has grown up so let her eat other foods" (FH11). Several mothers reported being told not to breastfeed their infant by hospital staff or to breastfeed for only 3 months (FGD2M, FGD2F, and FGD1X). Finally, two women claimed they did not use FH although they were considering it, because of their husband's attitude: "He said he is not interested in such kind of things in his house" (FH14).

Continuation of FH: promoters and barriers

Study staff were the most commonly mentioned important facilitators of FH. Nine women were explicit about how peer counselors played a particularly key role: "She encouraged me and that is the reason I continue up to now, otherwise I would have stopped by now" (FH09), and "It is only them who know our health, our condition, and how we are struggling" (FH10). Tellingly, peer counselors used the term "friendship" to describe their relationship with some of the mothers.

Eight women described how FH contributed to the good health of their infants: "It is a good way which will help the baby to avoid infections but at the same time she gets the nutrients found in mothers' milk" (FH17). Participants and counselors alike reported how mothers who were not part of the study asked about FH after observing how healthy study infants looked.

The support of household members also facilitated continuation of FH. Women most frequently referred to household support as being from their husbands; there was one mention each of support from a grandfather, an older child, and a maid: "If the husband is aware of the situation, it will be easy for a woman to perform this exercise because she will be free to do it even if her husband is present" (FH04), and "This method is tough. If this woman can inform her family members, they will not be surprised of what she is doing. Otherwise it is very difficult" (FH14).

Because most of the materials needed for FH are normally already in the home, women thought there was a financial advantage to FH: "What I liked most about this is that …I do not buy it, I have the milk" (FH15).

Many of the women found that the pamphlets on FH were helpful: "The pamphlets should be given to everybody so that they can do it alone at home" (FH19), and "They provide understanding, and if one also observes it in person, it helps" (FH10).

The most important barrier to continuation was fear that FH could lead to disclosure of their HIV status to family and friends: "I did not tell him [my husband] because if I let him know [I was infected] he would stop supporting me, and could abandon my baby and me" (FH16), "Since I told [my friend], our friendship has ceased" (FH09), and "Problems started immediately after telling [my husband]. He started abusing me; he said I am the one who brought in the disease" (FH14). As a result, many women hid FH. Four participants mentioned hiding FH from their husbands: "He has never seen me [FH]" (FH06). One mother explained how hard it was to flash-heat without her husband knowing: "At night when a baby cries what did you want me to do? My husband is sleeping there, then I have to wake up and start expressing, warm it, then feed the baby? Is that practically possible?" (FH15). Four different participants described the difficulties with hiding FH from friends: "I run to my room, they ask me why don't I breastfeed her…I think they have a lot of questions to ask about my behavior but I don't give them time to ask me anything. So I have started losing friends" (FH08). Keeping the FH process a secret was very challenging.

Similarly, as much as women appreciated support from the study, the suspicions raised by peer counselor home visits made them problematic for at least three women: "I feel so good [about visits], but the problem is, I am not free to be with her.…If she visits me frequently it will create a certain picture and people will start to suspect something is wrong. But I am highly in need of her, what can I do to avoid this shame in the community?" (FH02). Counselors also reported how disclosure made visits much easier: "Those who are open about their status …will tell you to visit them once per week and they give you day and time of visit.…They get great benefits of being educated compared to the other group [who had not disclosed]" (FGD2H). Potential stigma associated with home visits likely played an important role in the occurrence of fewer home visits than originally planned (approximately bimonthly instead of weekly).

Unfamiliarity of the community with expressing and heating milk was a barrier cited by four women: "It is not our tradition to express milk and Flash-heat, it is not normal" (FH11). Five women did not believe in the efficaciousness of FH, even after initiating it: "I don't have much trust that my baby will not be infected so I have decided to give the baby other foods because so far she is negative" (FH16), and "I believe, but not 100%" (FH02). The other major barrier to FH was competing responsibilities; six women mentioned that FH took too much time away from their other duties: "There are other responsibilities apart from taking care of a baby, like going to the market and other small businesses which help us to have an income, so sometimes I have to stop other activities to do this exercise" (FH07).

Tactics for continuing FH

Both counselors and mothers described multiple tactics women used to continue FH despite the barriers faced: "Even if it's against the norm, when you educate mothers about benefits, they usually look for all strategies to prevent the babies from disease" (FGD3). One mother who was hiding FH

said: "You need to hide yourself when you are doing this process, especially when you have visitors. Sometimes…what you will do is to say 'I'm sorry my husband is sleeping' while it is not true, so that you [can go inside and] express milk" (FH05).

Another tactic was prevarication about the reasons for FH: "They ask me why I don't breastfeed her, I have to lie that I have a problem in my breast" (FH08). Another mother described how she convinced her maid that it was normal: "I got her from rural areas and she is not well exposed, she sees it as normal. I usually tell her that it is an urban style" (FH09).

A third tactic was to disguise their relationship with the peer counselors (e.g., claiming the peer counselor was a relative or friend). Peer counselors also commented on the importance of not being seen as nurses and described themselves "not as counselors [which has connotations of HIV], but as advocating for breastfeeding among mothers" (FGD2I).

Suggestions for future FH interventions

Study participants and counselors alike were adamant that more women should have the opportunity to learn about FH. Indeed, 2 years after the conclusion of the study, peer counselors continue to receive inquiries for support with FH (FGD3). Community education was the most commonly cited suggestion by mothers and counselors for improving the uptake and duration of FH: "The society should be educated about this matter so that they can see it as a normal thing; this will help us to be free when doing this exercise" (FH08). Peer counselors were unanimous in their opinion that a massive public health education was the best—if not the only—way to get around the secrecy many women felt necessary (FGD1).

Seven participants mentioned that nutritional support would help them to better succeed at FH. Finally, despite the potential stigma, six women expressed the desire for peer counselors visits until the child was older than 9 months: "If you continue providing counseling on FH, it will last longer" (FH07).

Discussion

This study provides some of the first insights into barriers and promoters of home-based breastmilk pasteurization. Education and support provided by peer counselors were seen as the most important promoters of success (Table 1). Both the technical knowledge they provided to individuals (Level 1) and the interpersonal relationships (Level 2) developed through encouragement and support promoted the initiation and continuation of FH. In contrast, the most important barrier to FH permeated all four levels: the stigma associated with disclosure of HIV.

Individual-level barriers that are modifiable and can be addressed in future FH interventions include improving maternal understanding of FH procedures (e.g., increasing familiarity with manual expression, emphasizing correct duration of heating milk, explaining how heat inactivates virus) and reducing some of the stigma of peer counselor home visits (e.g., by providing the option of clinic-based counseling). Batch heating of milk from multiple expressions is currently under investigation and would facilitate more frequent expression and the conservation of fuel.

However, barriers that individual infant feeding counseling alone cannot address appear to include the stigma of breastmilk pasteurization for women who have not disclosed their disease, perceived inadequate maternal nutritional intake, insufficient household resources (e.g., fuel, help with childcare), and community unfamiliarity with FH. There are several potential strategies for addressing these barriers that should be explored. For example, a community-based campaign that encouraged breastmilk pasteurization for any mother who leaves expressed breastmilk, regardless of HIV status, as implemented in the only other field-based study of breastmilk pasteurization[18] and suggested in an acceptability study of FH[19] may reduce stigma of breastmilk expression and heating.

Mothers and counselors were clearly interested in promoting FH beyond the study. That mothers who were not part of the study asked about FH after observing the health of study infants suggests that nonparticipants may be as well. Clearly there is an unmet need for making breastmilk safer.

One limitation to this study is that only two women who were unwilling to attempt FH were willing to be interviewed about their reasons for refusal. Also, the preservation of anonymity during in-depth interviews made it impossible to link data from interviews to women's sociodemographic data or quantitative FH behaviors.

In summary, this research has demonstrated that FH is feasible in a "real-world" setting with modest support from peer counselors. A multilevel intervention that considers the broader social context in which infant feeding decisions are made (i.e., one that addresses barriers to FH at multiple levels) would likely improve uptake. Given the acknowledged importance of safe breastmilk in reducing vertical transmission,[20] future studies of both the implementation and clinical consequences of FH are urgently needed.

Disclosure Statement

No competing financial interests exist.

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