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PREVENTING POSTNATAL TRANSMISSION OF HIV-1 THROUGH BREASTFEEDING: MODIFYING INFANT FEEDING PRACTICES

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Abstract

Approaches to reduce or prevent the risk of postnatal transmission through breastfeeding include the avoidance of all BF and the use of exclusive replacement feeds (RF) or exclusive breastfeeding for a limited duration with early and rapid cessation of BF around 4-6 months of age. The efficacy and safety of the latter approach has not been established and studies are in progress to provide further information. In addition, inactivation of HIV in breastmilk would allow breastfeeding to continue while reducing the risk of postnatal transmission of HIV, and may be usefully applied in certain circumstances, such as for premature infants or while a mother recovers from mastitits. In this review, experience from clinical trials or studies additional to their main objective of assessing rates and risk factors for MTCT, is discussed. This may inform policy, programming and training options, and be especially valuable in the absence of conclusive data of the efficacy of the interventions to be applied during the breastfeeding period.

Introduction

The success and availability of anti-retroviral drugs (ARV) interventions that effectively reduce *in utero* and intrapartum transmission of HIV has shifted the focus of clinical research to identifying interventions that will reduce postnatal transmission of HIV through breastmilk. One such option is to provide antiretroviral therapy to the mother who is breastfeeding (BF) or to the child for the period of BF or to both. The results of clinical trials to establish the efficacy of these interventions will not, however, be available for two to three years. Alternative approaches include the avoidance of all BF and the use of exclusive replacement feeds (RF) or exclusive breastfeeding for a limited duration with early and rapid cessation of BF around 4-6 months of age. The efficacy and safety of the latter approach has not been established and studies are in progress to provide further information. Finally, several approaches to inactivate HIV in breastmilk are being assessed, which would allow breastfeeding to continue while reducing the risk of postnatal transmission of HIV.

The operational experience of programmes focussing on the prevention of mother to child transmission (PMTCT) in many countries in sub-Saharan Africa highlight the complexity of delivering a critical component in the process of preventing mother to child transmission, namely voluntary counselling and testing. More difficult again is the task of sensitively and comprehensively counselling women on realistic, sustainable infant feeding choices that will optimise her child's chance of survival. This experience needs to be borne in mind because sophisticated interventions such as those described above are proposed as public health interventions to avert MTCT.

In this review, experience from clinical trials or studies additional to their main objective of assessing rates and risk factors for MTCT, is discussed. This may inform policy, programming and training options, and be especially valuable in the absence of conclusive data of the efficacy of the

interventions to be applied during the breastfeeding period. For the purpose of this review, the definitions listed in Table 1 are used.

Complete avoidance of breastfeeding

A policy of complete avoidance of BF by providing free FF is being evaluated in 5 clinical studies and 2 operational settings in Abidjan, Côte d'Ivoire; Nairobi, Kenya; Soweto and Khayelitsha, South Africa and Bangkok, Thailand. All studies were conducted in urban populations where women of unknown HIV status usually initiate BF but thereafter commonly introduce fluids, milks and foods within the first weeks of life and would thus be mixed BF (MBF). Determinants of choice and patterns of infant feeding are described below.

In a study in Abidjan, Cote d'Ivoire, all HIV positive women in six health community centres who accepted VCT were offered a peripartum intervention including AZT and NVP, multivitamins and malaria prophylaxis (1). They were counselled antenatally on infant feeding practices. Two infant feeding options were available: a free supply of FF with bottles and sterilising materials for nine months from birth of the infant, with a drug inhibiting lactation; or exclusive breastfeeding for three months followed by early cessation of breastfeeding. All mother-infant pairs were closely followed for two years, with further infant feeding advice provided at each visit (2). Between March 2001 and May 2002, 323 HIV-positive women were enrolled in the study, of whom 256 had a live birth and had fed their child at least once. Median maternal CD4+ count at inclusion to the study was 354/mm^3 (interquartile range: 239-517); nearly 20% of women had a CD4+ count less than 200/mm^3. All but one woman expressed a prenatal choice of feeding practice, with a little over half planning to FF from birth while the rest planned to BF. About 80% of the women who planned to FF were doing so at day 2 post-partum, and of the women who planned to EBF, half were EBF, but nearly 45% were PBF. Women who were living with their partner and those without formal

education were less likely to plan to FF. Infant feeding intention did not appear to be association with level of schooling, personal income or access to any source of water. Based on the limited number of children followed for more than three months, 75% of infants were still reportedly receiving only FF. Family pressures were reported as the main reason for changing practice.

In Nairobi, Kenya, 425 pregnant womenwere randomised to either BF or FF (3). FF were provided free and all women were counselled against MBF. Of 195 women randomised to FF and who provided information on feeding practices three-quarters reported giving only FF, while the remaining women reported BF in addition to FF. Women who were compliant with their randomised mode of infant feeding were generally older, had fewer previous live births and had previous experience of BF. Table 2 shows the clinical, virological and immune characteristics of women and their infant feeding practice. Women who reported some symptoms suggestive of advanced HIV disease or who had higher viral load tended to be more compliant with EFF; however these women did not have lower CD4 counts or additional reports of TB infection.

As a follow-up to this study and to investigate the influence of free provision of FF on women's decisions and practices similar data was collected from HIV infected women who were not offered or given free FF (4). Data was available on 128 women during pregnancy. Median age was 25 years and 74% had had a previous pregnancy; only 40% had received secondary education or higher; and as many as 72% had informed their partner of the HIV test result. Ninety one percent of women knew that HIV could be transmitted through breast milk and 73% were aware of the risks associated with giving RF. Of the women who had declared an antenatal intention to give a RF, two-thirds were exclusively RF at one week and about 70% at six weeks. Compared to women who did not exclusively RF, women who exclusively RF at one week planned not to BF (OR 5.1), had higher income (OR 2.0), and had spouses who were willing to have an HIV test (OR 3.1). There were 25

women who were mixed feeders at one week and 34 at six weeks; these women indicated to have received conflicting information from health care workers and to have been influenced by relatives.

In South Africa, experience has been gathered from clinical research sites in Soweto, Johannesburg and operational sites in Khayelitsha, Cape Town. In a randomised trial evaluating the effect of two antiretroviral (Nevirapine alone versus ZDV alone) infant regimens on peripartum transmission 83% and 86% of women in the NVP and ZDV arms respectively elected to formula feed (6). Formula milk was offered free to women enrolled in the study but bottles and sterilising materials were not otherwise provided. At 6 weeks, EFF was reported by 84% women in the NVP group and 86% in the ZDV group. Mixed BF was reported by 4% in both groups and breastfeeding by 13% and 11% respectively. In a cross-sectional survey amongst 113 women who were part of a PMTCT programme, 71% had piped water in their house and the remaining 29% had to walk a median time of 5 minutes to fetch water from public taps; 75% women had electricity in their homes. Formula milk was provided free by the PMTCT programme but no support was offered to women who choose to BF. One hundred and eight women did not report BF at any time since their child was born; and 5 women women reported BF for a few days only. Women indicated that they chose to FF because they were advised to do so by their nurse/counsellor, because of their HIV status and health reasons, and for a few family pressures or as an interim measure until they disclosed their status. Most women (70%) did not report any diarrhoeal episodes in their children, while a quarter reported their child to have suffered an episode of diarrhoea.

In Thailand, the government PMTCT programme actively endorses FF by all women. This policy has been generally acceptable throughout the country and uptake of FF was reported to be over 80% in 2001/2002. In research sites, almost 100% of HIV infected women are reported to be FF, only 6% of women are reported to have ever BF compared with >95% in the HIV uninfected population. Amongst the HIV positive women 62% were concerned about not BF and 70% acknowledged that

other family members and friends were concerned about their avoidance of BF. About half had found it hard to explain to other people in the community why they were not BF. No morbidity or mortality data was available from these sites.

In summary, FF was an acceptable feeding option to many HIV positive women in urban settings with education or intensive counselling, adequate water supply and when the FF was provided free; high compliance to EFF can be successfully achieved in both research and government PMTCT programmes. Low morbidity can be achieved in some settings but to date there is little longitudinal data available from operational sites to quantify the relative risks in these settings. Choice and practice were significantly influenced by the advice of health workers, social and family pressures but also women's insights regarding HIV infection and the risks of RF. Innovative approaches to reducing stigma and positively involving men and fathers in infant feeding choices and practices are urgently needed.

Avoidance of mixed feeding and early cessation of breastfeeding

The concern around increased morbidity and mortality associated with the use of FF underlies the WHO/UNICEF/UNAIDS recommendation that EBF should be practiced by HIV-infected women who cannot practice safe FF (7). The possibility that EBF might also be associated with a lower transmission risk than MBF (8) has prompted several clinical studies in which the feasibility of EBF at a population level is examined and to encourage women to avoid MBF. Four studies are discussed that are testing this hypothesis and the risks associated with stopping BF earlier or more abruptly than usual.

In Abidjan, Côte d'Ivoire, women taking part in the project described above who elect to BF were followed-up according to the same protocol. During follow-up the potential risks of MBF were

discussed repeatedly and women were specifically counselled on how they might stop BF and when would be appropriate and possible in their circumstance. This could be any time up to six months postpartum. Counselling also included practical demonstrations on how to use a cup for giving RF and workshops on preparing complementary feeds (CF). Women were offered free FF for nine months starting from the time that they stopped BF. There was no support offered in the postnatal wards to help initiate BF or to sustain EBF in the first days, nor was there specific counselling at the antenatal clinics preparing women for initiating and sustaining EBF. One-week recall of infant feeding and morbidity data was collected at each study visit (weekly for the first six weeks, monthly until 12 months and three-monthly until two years). Forty per cent of women planned to BF, and on day two postnatally half EBF. However, within the first 48 hours post-delivery, more than 40% of mothers had already introduced additional fluids (other than FF).. None of the mothers who had introduced fluids only in the first 48 hours i.e. predominant BF (PBF) had reverted to EBF to three months. Mothers reported that stopping BF at three months was difficult, but counsellors reported fewer difficulties from mothers who ceased BF when the child was older, about 6 months.

The only study to be performed in a rural area is in KwaZulu Natal, South Africa where a large non-randomised community-based intervention study has been implemented to estimate the transmission risk with EBF (9). HIV positive women are counselled on infant feeding options but no FF or other financial or material support is offered regardless of preferred feeding intention. Women who plan to BF are intensively supported antenatally, at delivery and postnatally to EBF. The community-based support is matched by general support for EBF in the health facilities and local district hospital which is accredited with the Baby Friendly Hospital Initiative (BFHI). In the district, between 40-60% of households use river water and up to a third of households in certain tribal areas, have no form of toilet even pit latrines. In the past five years there have been outbreaks of Shigella *dysenteriae* type 1 dysentery and cholera. In contrast to some other approaches for counselling on infant feeding choices, not all infant feeding options are presented by the counsellor.

Rather the counsellor explores with the HIV-positive woman how she intends to feed her child now that she has learned her HIV status. After discussing her personal circumstances and considering the feasibility of her intention, the counsellor either fully supports the intention or sensitively challenges the women if her conditions do not appear appropriate with her intention or if a better opportunity is available. This approach reflects the WHO/UNICEF/UNAIDS recommendation that HIV-infected women are given 'specific guidance in selecting the option most likely to be suitable for their situation'.

Of 189 HIV-infected women counselled 90% planned to BF and 10% intended to FF. There were no differences between the BF and FF groups with respect to access to clean water (about 50%), access to a fridge (about 40%), gas, paraffin or electricity as a fuel source (about 65%) and a regular source of income to the household (about 75%). Only if the woman herself was the main income provider was this associated with the intention to FF (9% vs. 28%). Access to some or all of these conditions, which reflect issues of safety, affordability and sustainability of RF, was not associated with either feeding intention (table 3). Most women who had immediate access to conditions that would enable making RF safer in fact chose to BF, suggesting that women's choices were based on issues other than physical resources. Notably, two-thirds of women who antenatally planned to RF instead initiated and sustained BF after delivery whereas all women who planned to BF managed to do so through at least the first week. HIV counsellors reported that women were very receptive to information and support regarding good breastfeeding practices but commented that it was hard to counsel women knowing that they are hungry. Not unexpectedly they found that family concerns significantly influenced women's decisions and practices. Interim data suggest that breast pathologies were uncommon but oral thrush was common during the first months of life in breastfed infants.

The Zambian exclusive breastfeeding study (ZEBS) in Lusaka, Zambia is an randomised clinical trial to test the safety and efficacy of short exclusive breastfeeding to four months to reduce HIV transmission and child mortality, enrolling 1200 infected pregnant women who wish to breastfeed (10,11). A counselling intervention was developed to support and encourage exclusive breastfeeding to at least four months among all women in the study. Counselling begins antenatally, breastfeeding initiation is supported by midwives after delivery, and postnatal counselling includes both a home and clinic-based component. Women randomised to abrupt cessation of all breastfeeding at four months receive an additional counselling intervention to prepare them for early cessation. Possible problems associated with breastfeeding cessation are discussed including strategies to relieve breast engorgement and comfort the child without suckling. Cup feeding is introduced and nutrition guidance is offered. Women randomised to the early cessation group are given infant formula and a fortified cereal for at least three months, as part of the study intervention. The study will monitor the risk of HIV infection and serious morbidity and mortality, and aims to quantify the risk of HIV transmission through exclusive breastfeeding and the magnitude of reduction of postnatal transmission associated with early cessation at four months.

Among the first 400 women enrolled in the study, more than 90% of all women initiated EBF. Between birth and one week, 92% of women reported breastfeeding only in the complete absence of any other liquid or semi-solid. Between one week and one month, cross-sectional recall of feeding indicated EBF was 95%, between one and two months, 96%, between two and three months 92% and between three and four months 86%. Most reports of non-EBF were single instances of water or other supplements and many mothers reverted to EBF thereafter. Among the mothers randomised to abrupt early cessation of breastfeeding at four months, 80% stopped all breastfeeding. Most women who stopped breastfeeding did so within a week (<2 days: 50%; 2-7 days: 42%) with 8% stopping within two weeks. There preliminary results suggest that exclusive breastfeeding may be a feasible intervention which can be achieved among the majority of HIV-infected women with appropriate

counselling. Early and abrupt cessation also appears to be feasible with counselling and provision of infant formula and weaning foods. However, the efficacy and safety is still unknown. Early data suggest that compared to those who continued breastfeeding for longer, mothers and infants who stopped breastfeeding at four months were more likely to visit clinics and health worker, incurred a significantly greater number of diarrhoeal episodes and had lower weights.

The ZVITAMBO study in Harare, Zimbabwe was a randomised trial to investigate the effect of vitamin A supplementation on maternal and infant health, recruiting 14,110 mother-infant pairs during the immediate post partum period. At recruitment, 4,496 (32%) of mothers were HIV-infected. Detailed infant feeding and morbidity data were routinely collected and blood samples obtained at six weeks, three months, and then at three-monthly intervals over a two-year follow-up. All but four of the 14,110 mothers initiated breast feeding. During the course of the study an education and counselling programme on safer breastfeeding was introduced for the last 2,744 women enrolled. Using the definition of. cumulative practice from birth (rather than less rigorous definitions of 24 hour or 1 week histories), EBF rates increased from 7% to 28% at six weeks of age and from 3% to 19% at three months of age, for the pre- and post-education and counselling intervention cohorts, respectively. This illustrates that breastfeeding practices are amenable to change if an effective and committed approach is implemented and sustained. Similarly, in Zimbabwe when RF were given, cups are normally used rather bottle which has been the government recommendation for many years. Among infants born to HIV-positive mothers, infant mortality was more than three-fold greater ($p<0.01$) among infants who were MBF by three months of age compared to those who were EBF to at least three months of age.

In summary, EBF is an acceptable and feasible feeding option for many HIV positive women especially where practical support is available. Early introduction of water is common in many communities and achieving EBF beyond the first months can be difficult if only limited support is

offered. Avoiding the introduction of additional FF rather than just other fluids e.g. water is more acceptable and easier to achieve. Moderate facility-based and/or community-based support both antenatally and around delivery can significantly increase EBF rates. Obvious determinants of practice such as physical resources at home are not always the principal basis of choice or practice. Women's status in many societies often prevents her from making and exercising her choice. Counselling approaches need to effectively guide women to informed choices with support available to make these choices viable and sustainable. Further investigation is needed of methods to increase community acceptability of feeding interventions to reduce HIV transmission and increase child survival.

Preventing / treating breast pathology and infant thrush

Breast pathologies, whether clinical or subclinical are described among the risk factors for postnatal transmission, although their effect at a population level remains to be quantified (see John-Stewart in this issue). Simple interventions to improve BF practices and thereby decrease these risks are attractive methods to make BF safer. The South African and Zambian studies described above will better quantify the transmission risks of various breast pathologies, but there is again little data that has been systematically and rigorously collected in operational settings. It is expected that improved lactation counselling, which lies at the heart of interventions to promote exclusive breastfeeding, should reduce breast pathology but this remains to be demonstrated in the ongoing trials and studies.

In Cato Manor clinic, a government clinic serving a large urban population in an informal settlement in Durban, HIV counsellors have also been trained in the WHO Breastfeeding Counselling Course and can competently describe the common breast pathologies. After HIV positive mothers have decided how they plan to feed their child (following counselling), HIV counsellors meet with them at least once more to prepare them for feeding in the first week

postnatally. For mothers who have chosen to breastfeed this includes early initiation of BF, correct positioning and attachment, frequent feeding and exclusive BF, how to cope with sore nipples and expressing breastmilk to avoid engorgement. If the opportunity presents at subsequent antenatal visits the counsellor will also discuss nutritional support for the mother and good food choices. To date, 288 women have enrolled into the PMTCT programme since March 1999. Six month follow-up data is available on 179 mother-infant pairs where the mother has chosen to BF. Cracked nipples were experienced by 12% of mothers (similar to the 11-13% rate quoted by Embree et al (12)). This was usually in the first month of life and was rarely associated with bleeding. Breastfeeding counsellors, either the HIV counsellor or another dedicated breastfeeding counsellor, would recommend applying pure lanolin ointment and/or breastmilk to the affected nipple. In addition, the counsellor advises the mother to expose the breast to sunlight whenever she can. If the infant has oral thrush or if nipple candida is suspected then nystatin ointment is also recommended. The mother is advised to continue feeding from the breast unless there is obvious bleeding. Mastitis was diagnosed in only 2% of mothers (compared to 7-11% in Nairobi (12)). Management of mastitis included using warm cloths to ease engorgement, expressing and discarding breastmilk from the affected breast while continuing feeding from the unaffected breast and giving the mother antibiotics. Infant thrush was seen commonly – 39% infants were diagnosed with oral thrush on at least one occasion in the first 6 months. They were treated with oral nystatin drops. No data is, as yet, available on the HIV status of these infants.

Breastmilk treatment

HIV is heat sensitive and is inactivated by pasteurisation at temperatures between 56 and 62°C (13). Breastmilk banks in developed countries use expensive, thermostatically controlled, pasteurising equipment which is not available in resource poor settings. A low cost, low-tech method, the Pretoria Pasteurisation method, makes use of passive heat transfer from water which has been heated to boiling point, to milk which is contained in a glass jar standing in the water. The woman

expresses her milk into a clean glass peanut butter jar, which is thenplaced into a one liter aluminium cooking pot. Water is boiled by any methods and when boiling vigorously, the hot water is poured into the cooking pot in which the jar of milk is standing. The jar and milk are left to stand in the hot water until the water is a comfortable temperature, approximately 25 minutes. The final temperature reached by the milk and the duration for which it remains at that temperature is dependent on the volume of boiling water, and the sizes and materials of the milk and water containers. Using water at boiling point has the advantage that it can be achieved every time without the need for a thermometer or thermostat. Several sets of apparatus were investigated and the glass jar and aluminium pot were found to provide the best results. The desired temperature range is between 56 and 62°C as this will maintain a large proportion of the secretory IgA within the milk (14). The method was tested and found to be reliable under a wide range of conditions (15).

The Pretoria Pasteurisation Method has been shown to reliably inactivate HIV in the milk of HIV infected women, as well as in high titre cell free and cell-associated virus inoculated into human milk (16). The method was implemented at Kalafong hospital, South Africa, at the end 2001 for feeding pre-term infants born to HIV-infected mothers who found the method acceptable and easy to perform. By August 2002, 38 infants had been followed to three months of age or more. The mean birth weight in this group was 1488gr (plus or minus 490gr). Two infants died, the first of which was discharged at six weeks of age in a satisfactory condition, but at this time the mother elected to change to formula-feeding and the infant died from diarrhoeas six weeks later; the second infant had a birth weight of 1100 gr and died on day five from complications of severe prematurity. All 36 other infants had satisfactory weight gain and were discharged from hospital. After leaving hospital, 20 mothers claimed to have continued with the Pretoria Pasteurisation. Others indicated that they had stopped using the method because of the fear of disclosing their HIV status to family or community members. Others were influenced by family members to use more traditionally

acceptable feeding methods. The introduction of Pretoria Pasteurisation into the neonatal unit obviated the need for placing at least 25% of the infants onto formula feeds and was associated with a reduction in the number of cases of necrotising enterocolitis from 11 in the preceding year to three in the 11 months following the introduction of the Pretoria method.

Heat treated expressed breastmilk (HTEBM) has also been recommended and supported at the Cato Manor site in Durban. It was poorly accepted by mothers, only 6% ever gave HTEBM in the first 6 months, who commented that it was only a viable option from 6 months of age. Counsellors were surprised at the low uptake of HTEBM and discussed reasons for this with the mothers. Some of the reasons put forward for low uptake were that there had been no official endorsement or media coverage of the method and that they felt that a reduced amount of milk would be expressed and therefore the baby would not be satisfied. Other mothers, who did not have the opportunity to see a demonstration or try it out under supervision, stated that they lacked confidence in the procedure. Some mothers were concerned about the possibility of stigmatisation or associations being made in the community regarding of heat treatment and witchcraft; finally, and perhaps most practically mothers found it too time consuming especially when FF is readily available as an alternative. In an effort to promote HTEBM the Cato Manor team has produced a video on breastfeeding with a section on heat treatment. A separate room for nutrition counselling and demonstrating heat treatment has been set up. Finally, the counsellors are encouraging mother to express and heat-treat breastmilk from early on so that it becomes a normal practice.

In summary, correctly applied heat treatment of expressed breast milk can reliably inactivate HIV within the milk. It is easy to implement for motivated women but avoidance of suckling the infant and contending with family and community pressures are serious considerations for success. Pretoria Pasteurisation is a useful method for feeding pre-term infants born to HIV infected mothers in an institutional setting but its use in a domestic setting and for term infants requires further

investigation. It may have a valuable role as an alternative to exclusive breastfeeding during times of increased risk, such as mastitis and cracked or bleeding nipples.

Comment

The experience from these studies suggests that both EFF and EBF are acceptable and feasible options to HIV positive women to reduce mother-to-child transmission of HIV. The decision-making process and the ability to achieve these depends on the personal motivation of HIV infected women, the support of partners and close family and the practical support of health care staff. Programmes that promote EBF in populations where HIV is not a major problem clearly demonstrate the feasibility of achieving high EBF rates especially for the first months of life; the BFHI has been able to mobilise the enthusiasm and commitment of all sectors of communities to support EBF. In Nigeria, communities have been designated 'Baby Friendly' by national BFHI committees because of the practical support they offer to enable women to EBF. This experience should be exploited in communities where EBF is likely to be widely adopted by HIV positive women. Similarly the widespread use of cups to feed small babies in Zimbabwe illustrates how community practices can be changed when the political commitment is given to such health initiatives. Greater understanding is needed of the support that is needed by women who choose EFF in order to avoid mixed feeding.

It is not clear at present whether there are differential risks associated with different types of non-EBF i.e. predominant vs. partial vs. mixed breastfeeding. The mortality data from the Zvitambo study suggest that this may be the case but the HIV transmission data for these children is not yet available. Operational experience suggests that it is possible to avoid mixing of BF with other non-human milks but that social pressures often result in mothers adding at least other fluids or foods. It is unlikely that, if EBF is protective, it will be an all or nothing phenomena and the addition of

water may carry a different risk from the addition of more complex proteins and foods such as FF or other non-human milks. Even if antiretroviral prophylaxis to mother or infant in the breastfeeding period (see Gaillard et al in this issue) is shown to significantly reduce the risk of transmission through breastfeeding this is unlikely to become widely available quickly. Reliable knowledge about other approaches on how to make breastfeeding safer for HIV infected women is thus not only of scientific interest but also of public health importance.

Table 1. Infant feeding

Breastfeeding	BF	Any type of breastfeeding
Breastmilk substitute	BMS	Any food being marketed or otherwise represented as a partial or total replacement of breast milk, whether or not suitable for that purpose
Cessation of BF	CB	Completely stopping breastfeeding, including suckling at the breast
Complementary feeding	CF	The giving of complementary foods in addition to breast milk or infant formula. These are any food, whether manufactured or locally prepared, suitable as a complement to breast milk or to infant formula when either becomes insufficient to satisfy the nutritional requirements of the infant.
Exclusive breastfeeding	EBF	Breastfeeding only – no other fluids, milks or feeds including non-prescribed medications
Formula feeding	FF	Use of commercial infant formula that is formulated industrially in accordance with applicable Codex Alimentarius standards to satisfy the nutritional requirements of infants during the first months of life up to the introduction of complementary foods.
Exclusive Formula feeding	EFF	Formula-feeding only, never breastfed
Mixed breastfeeding	MBF	Breastfeeding with the addition of fluids, solid feeds and non-human milks such as FF
Partial breastfeeding	PF	Breastfeeding with the addition of fluids other than milks and other solid feeds e.g. porridge
Predominant breastfeeding	PBF	Breastfeeding with the addition of fluids other than milks
Replacement feeding	RF	The process of feeding a child who is not receiving any breast milk with a diet that provides all the nutrients the child needs until the child is fully fed on family foods

T**able 2.** Clinical, virological and immune characteristics of women and their infant feeding practices. Nairobi, Kenya

Clinical characteristics	**Compliant with EFF (N=142)**	**Non-compliant with EFF (N=53)**	**P**
Itchy skin rash	22%	6%	0.008
Cough > 1 month	7%	2%	0.2
History of shingles	4%	0%	0.2
History of TB	1%	0%	0.5
HIV symptoms*	26%	13%	0.06
Immunological characteristics			
CD4 /mm^3	411	399	0.9
CD8 /mm^3	846	728	0.06
CD4%	23	25	0.2
CD4<200 (%)	13%	11%	0.8
CD4/CD8 ratio	0.51	0.56	0.06
Prenatal viral load (mean/median)	54,650 (SD or range)	20,515 (SD or range)	0.04

HIV symptoms included:

Table 3. Cumulative number of conditions (clean water; access to fridge; electricity, gas or paraffin for cooking; regular income available to household) available to HIV-infected women to make replacement feeding affordable, feasible, sustainable and safe compared with their antenatal feeding intention

		NUMBER OF CONDITIONS AVAILABLE TO WOMAN*				
	N	**NONE**	**1**	**2**	**3**	**4**
FEEDING INTENTION		**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**
EBF	171	19	35	40	52	25
		(11)	(21)	(23)	(30)	(15)
RF	18	1	3	6	5	3
		(6)	(17)	(33)	(27)	(17)

* i.e. any combination of safe water, access to fridge/freezer, fuel other than wood and regular income

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