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Household food insecurity, maternal nutritional status, and infant feeding practices among HIV-infected Ugandan women receiving combination antiretroviral therapy

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Abstract

Objectives—Household food insecurity may be a barrier to both optimal maternal nutritional status and infant feeding practices, but few studies have tested this relationship quantitatively, and never among HIV-infected individuals. We therefore explored if greater household food insecurity was associated with poorer maternal nutritional status, shorter duration of exclusive breastfeeding (EBF) and fewer animal-source complementary foods.

Methods—We assessed these outcomes among 180 HIV-infected pregnant and breastfeeding (BF) women receiving combination antiretroviral therapy in the PROMOTE trial (NCT00993031), a prospective, longitudinal cohort study in Tororo, Uganda.

Results—Household food insecurity was common; the prevalence of severe, moderate, and little to no household hunger was 7.3%, 40.5%, and 52.2%, respectively. Poor maternal nutritional status was common and women in households experiencing moderate to severe household hunger (MSHH) had statistically significantly lower BMIs at enrollment (21.3 vs 22.5, $p<0.01$) and prior to delivery (22.6 vs. 23.8, $p<0.01$). However, MSHH was not associated with maternal BMI or gestational weight gain in multivariate models. The prevalence (95% CI) of EBF at 6 months was 66.4% (59.0%-72.8%), and the proportion of women breastfeeding at 12 months was 80.0% (73.0%-85.3%).MSHH was not associated with EBF at 6 months or breastfeeding at 12 months.

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However, among those women still EBF at 4 months (81.0% of population), those experiencing MSHH were significantly more likely to cease EBF between 4 and 6 months (aHR: 2.52, 95% CI 1.03-6.19).

Conclusions—Interventions addressing household food insecurity, maternal malnutrition and suboptimal breastfeeding practices are urgently needed.

Keywords

food security; nutrition; exclusive breastfeeding; HIV/AIDS; Africa; Sub-Saharan Africa; complementary feeding; maternal nutritional status

Introduction

The deleterious consequences of household food insecurity (HHFI) on the nutritional status of adults in the general adult population are well-established [1-3]. HHFI has also been associated with a number of non-nutrition related sequelae, including depression [4] and stress [5]. High levels of HHFI have also been documented among people living with HIV, for whom it has been identified as a risk factor for HIV transmission and disease progression [6-10].

The relationship between HHFI and maternal health during pregnancy and lactation is less well-understood. In the few available studies from low-resource settings, HHFI has been associated with maternal underweight [11], reduced maternal food intake among HIV-infected and uninfected lactating women [12] and increased risk of poor maternal anthropometric measures among HIV-infected and uninfected women with young children [13]. HHFI has also been associated with stress, anxiety, and depression during pregnancy [14, 15] and among child caretakers [4, 16-19].

The associations between HHFI and infant feeding are also not clear. Although infant feeding practices are one of the most important determinants of the health of young children, there are limited data on the relationship between HHFI and breastfeeding [20-22] and complementary feeding practices [19-21, 23]. Further, we are unaware of any studies evaluating the association between HHFI and infant feeding in the context of HIV.

Optimal infant feeding in the context of HIV in resource-poor settings includes 6 months of exclusive breastfeeding (EBF), introduction of daily animal source foods after 6 months of age [24], continuation of breastfeeding (BF) for at least 1 year and cessation of BF only after adequate complementary foods are available [25]. Such a feeding regimen reduces the risk of vertical transmission of HIV while providing optimal nutrition [26-28]. A recent study among HIV-exposed Tanzanian infants underscores the importance of EBF: each additional month of EBF was associated with a 49% reduction in infant mortality in the first 6 months of life [29].

Understanding the relationships between HHFI and both maternal health and infant feeding practices in the context of HIV is important for a number of reasons. These include the high prevalence of HHFI among people living with HIV [6, 30], the particular vulnerability of HIV-infected pregnant women to food insecurity [7, 15, 31, 32], the enormous influence of maternal health on infant health, and the importance of optimal infant feeding for the health of HIV-exposed infants [33]. Furthermore, HHFI may be a modifiable risk factor for poor maternal health and suboptimal infant feeding practices. Therefore, our objective was to describe HHFI, maternal nutrition and infant feeding practices among a cohort of HIV-infected women receiving combination antiretroviral therapy (cART) and to determine if greater food insecurity was associated with poorer maternal nutritional status during pregnancy or sub-optimal infant feeding practices in the first year of life. To our knowledge, this is the first published study of the relationship between household food insecurity, maternal nutritional status, and infant feeding practices among HIV-infected women.

Methods

Study design and population

Participants were women and infants participating in PROMOTE-Pregnant Women and Infant Study, an National Institute of Child Health and Human Development sponsored open label, single site randomized clinical trial at Tororo District Hospital, Uganda, whose primary outcome was the prevalence of placental malaria among women were randomized to receive either lopinavir/ritonavir or efavirenz-based cART (NCT00993031, http://clinicaltrials.gov). Women with HIV-1 infection and a documented pregnancy between 12 and 28 weeks of gestation were eligible for enrollment, and excluded if they had previously received cART, had received single-dose nevirapine within the prior 2 years, or had WHO stage 4 HIV disease. Inclusion criteria for this analysis included participating in the study between September 11, 2011 and January 11, 2012, having a singleton birth, and data available on HHFI. Women experiencing a neonatal death within the first 24 hours of birth were excluded.

All women gave written informed consent. The study protocol was approved by the School of Medicine's Research and Ethics Committee at Makerere University, the Uganda National Council of Science and Technology, the Committee on Human Research at the University of California San Francisco, and Cornell University.

Study procedures

At enrollment to PROMOTE, trained study staff collected demographic data and general medical, HIV, and obstetric history. HIV status was documented with a positive rapid HIV antibody test (Determine, Inverness Medical Japan Co., Japan) plus a confirmatory test (Stat-Pak, Chembio Diagnostic Systems, Inc., NY, USA). Gestational age at enrollment was estimated based on last menstrual period (LMP) and fetal ultrasound at the screening visit. Maternal height was measured to the nearest 0.1 cm using a Seca 206 wall-mounted measuring tape and maternal weight was measured at each visit to the nearest 500g using a Seca 876 mechanical scale until September 2011, thereafter a Seca 874 digital scale was used to measure weight to the nearest 50g. Women were randomized to either zidovudine/lamivudine/efavirenz or zidovudine/lamivudine/lopinavir/ritonavir. All women were also started on daily trimethoprim-sulfamethoxazole (TS) if they were not already receiving TS prophylaxis prior to study enrollment. Additionally, all women received multivitamins containing iron and folic acid, iron supplements, prophylactic mebendazole, and an insecticide-treated bed net.

During pregnancy, women returned to the study clinic every four weeks until delivery for scheduled study visits as well as when they experienced adverse events or any health conditions requiring evaluation. At monthly study visits, data were collected on general health, including maternal anthropometry. Women received counseling at monthly scheduled visits from one of two trained study counselors on infant feeding recommendations (including 6 months of EBF and 12 months of BF, aligned with national guidelines [34] and avoidance of premastication of food) and efficacy and safety of cART during BF. Study physicians also reiterated the importance of adherence to national BF recommendations during routine study visits. At each scheduled visit, women were given a 5-week supply of multivitamins, antiretroviral therapy, and TS.

After delivery, women and infants returned for monthly study visits until the infant reached 1 year of age. At scheduled monthly visits, infant feeding counseling continued. Women were asked by study physicians to recall infant feeding practices over the prior two days, including BF and the feeding of 9 food groups commonly fed to young children in that area: water (all types), tea (with and without milk or sugar), juices, milks (including infant formula and animal milks), eggs, animal flesh (meat, fish, chicken), insects, plant protein (beans, peanuts, sesame paste) and other solids (porridge, plantains, rice, potatoes, etc.).

Data were collected between September 11, 2011 and January 11, 2012 on HHFI and household assets, a proxy for socio-economic status (SES), once during a scheduled visit after enrollment on all women actively enrolled in the study. This period is when food insecurity is at its lowest in Tororo, such that food insecurity scores would be conservative estimates and have the least variation. Food insecurity in the prior month was assessed using the 9-item Household Food Insecurity Access Scale [35], which captures data on anxiety about food supply as well as quality and quantity of accessible food. It has previously been used among HIV-infected adults in rural Uganda [36-39]. It was pre-tested by study staff to confirm understanding prior to implementation.

A household assets measure was created based on possession, or not, of a radio, telephone, television, refrigerator, motorcycle, bicycle, and car. We used the first two components of a principle component analysis of household assets which accounted for 55.7% of the information contained in the asset holding variables. Women were then categorized as either having “high” household assets if they scored above the median for both components or “low” if not. The inclusion of the asset score in all models permitted differentiation of the effects of food insecurity from those of poverty. Global positioning system coordinates were used to categorize women's residence as urban or rural.

Laboratory evaluations were regularly conducted throughout the study including hemoglobin (Hb) (Beckman Coulter AcT 5diff CP), HIV RNA PCR (Roche Cobas Amplicor), and CD4/CD8 lymphocyte subsets (BD Biosciences FACSCalibur 3CA). Anemia was defined as Hb <11.0 g/dL. Clinical progression of HIV disease was categorized according to 2007 WHO criteria [40].

Outcomes

HHFI was operationalized using the Household Hunger Scale, which is a subset of 3 questions from the Household Food Insecurity Access Scale that pertain to insufficient food quantities [41]. We opted to use the Household Hunger Scale instead of the entire Household Food Insecurity Access Scale because of respondents' difficulties distinguishing between the frequency categories, as recognized by the scale's authors [42]. Scores of 0-1 are classified as "little to no HH"; 2-3 as "moderate HH" and 4-6 "severe HH" [41]. We classified women with scores 2-6 as experiencing "moderate or severe HH" (MSHH).

Maternal nutritional status was operationalized as BMI at various time points during pregnancy and total gestational weight gain (GWG). Because weekly maternal weight gain should be linear in the second and third trimesters [43], weekly gestational weight gain was calculated by dividing the weight change between enrollment and last weight before delivery by the number of weeks elapsed between the two.

An infant was classified as exclusively breastfed if the woman reported breastfeeding and did not report feeding any of the 9 foods queried about monthly. Oral rehydration solution, drops and syrups (vitamins, minerals or medicines) were permitted under this definition [44]. Once an infant was reported to have consumed non-breastmilk foods, they remained classified as non-exclusively breastfed. An infant was classified as breastfed if the woman reported BF in either of the two days of dietary recall. Animal source foods were non-human milk, animal flesh, and eggs.

Statistical analysis

Differences in baseline characteristics, maternal nutritional status during pregnancy, and infant feeding practices by MSHH were tested using Student's t-tests, Chi-square or Wilcoxon signed-rank tests as appropriate. Variables significantly associated with outcomes of interest (maternal BMI, GWG, EBF at 6 months, BF at 12 months) in univariate analysis at the $p < 0.20$ level were considered for inclusion into multivariate modeling. The relationships between MSHH and time to EBF and BF cessation were evaluated by Kaplan–Meier Survival analysis and Cox proportional hazards modeling. Extended Cox regression models were fitted where proportional hazards could not be assumed. Differences between MSHH in maternal BMI during pregnancy and total GWG were analyzed longitudinally using Generalized Estimating Equation (GEE) models accounting for repeated subject measures. All analyses were conducted using SAS version 9.2 (Cary, North Carolina).

Results

Study population

Of the 205 women actively enrolled in the PROMOTE study between September 11, 2011 and January 11, 2012, the HFIAS was administered to 199 (97.1%). Of these 199, 19 (9.5%) were excluded; 12 of these women experienced a stillbirth or a neonatal death within the first day of life and 7 delivered twins. Of the 180 women in this analysis, 9.4% were surveyed about their HHFI during pregnancy and 90.6% were surveyed after delivery. Of those surveyed after delivery the median infant age was 169.5 days, or 5.6 months.

Household hunger: prevalence, correlates

The prevalence of severe household hunger was 7.3%, moderate household hunger was 40.5%, and little to no household hunger was 52.2%. No significant differences in baseline demographics and health characteristics emerged by MSHH status (Table 1).

Maternal nutritional status and household hunger

At enrollment, women in households experiencing MSHH had statistically significant lower mean weights (54.5 kg vs 56.3 kg) and lower mean BMIs at enrollment (21.3 vs 22.5) and delivery (22.6 vs 23.8) (Table 2). Weekly and total GWG did not differ by MSHH, nor did the proportion of participants who lost weight between enrollment and delivery.

BMIs of women experiencing MSHH were consistently lower throughout pregnancy. The differences were statistically significant in univariate analyses, but not in multivariate analyses of BMI or total GWG. GEE models assessing the relationship between BMI during pregnancy and MSHH, controlling for gestational age, duration in study, birth spacing, asset score, and baseline maternal Hb, indicated that BMI across time during pregnancy was not significantly different by MSHH [adjusted beta (95%CI) -0.1195 (-0.2517, 0.0128), p=0.08]. GEE models assessing the relationship between total GWG and MSHH, controlling for gestational age, time pregnant while enrolled in the study, birth spacing, asset score, and CD4 at screening indicated that total GWG did not differ by MSHH [adjusted beta (95%CI) -0.1210 (-0.2610, 0.0190, p=0.09)].

Exclusive breastfeeding and household hunger

All women (100%) initiated BF at birth (Figure 1). The overall proportion of women EBF at 4 months was 81.0% (CI 74.5%-86.1%), EBF at 6 months was 66.4% (CI 59.0%-72.8%), and the median (IQR) overall duration of EBF was 6.4 (5.5-6.5) months. There were no significant differences in the proportion of women EBF at 6 months by MSHH and the rate of EBF cessation did not differ in the first 4 months by MSHH (aHR: 0.85, 95% CI (0.40-1.80) (Figure 1). However, extended Cox regression models controlling for BMI, CD4 and Hb (all at enrollment) revealed that among those women still EBF at 4 months, those experiencing MSHH were significantly more likely to cease EBF between 4 and 6 months (aHR: 2.52, 95% CI 1.03-6.19).

Any breastfeeding and household hunger

The proportion of women BF at 12 months was 80.0% (73.0% -85.3%), (Figure 2). There were no significant differences in the proportion of women BF at 12 months by household hunger. Further, there were no significant covariates predicting time to cessation of BF in multivariate modeling.

Complementary foods and household hunger

Although the median age of introduction for most foods was between 6 and 7 months, water and “other solids” were introduced to some infants very early (Figure 2). The median (IQR) age of introduction for animal source foods was 7.4 (6.5, 8.3) months for meats, 7.4 (6.4, 9.2) for non-human milks, and 8.3 (7.4,10.1) for eggs. There was no difference in either time of introduction of nonbreastmilk foods or proportion of infants receiving animal source foods in the prior two days by MSHH.

Discussion

In our study of 180 HIV-infected pregnant and lactating women in rural Uganda, we found that household hunger was very common; 47.8% of participants reported moderate or severe HH during the most food secure time of the year. Our findings were similar to the prevalence of moderate or severe HH reported among the general population in sub-Saharan African countries at varying points in the harvest cycle including in Mozambique [57.2%, 56.8% (2 studies)], Malawi (48.1%), Zimbabwe (48.3%), and South Africa (68.8%) [42]. We had expected that household hunger would have been higher in our cohort of HIV-infected women than in other studies in sub-Saharan Africa, since food insecurity is generally higher among HIV-infected populations [7, 9] and among women [31, 45, 46]; pregnancy may exacerbate food insecurity [15]; and Tororo is more food insecure than other areas of Uganda [47]. A reassessment of household hunger in the least food secure time of year would likely reveal a much higher prevalence.

Although the categories suggested by the Household Food Insecurity Access Scale have been identified as problematic for several reasons [41], their application to our data is nevertheless illustrative for purposes of comparison of the two scales: 76.7% of participants were severely food insecure, 18.3% were moderately food insecure, 3.9% were mildly food insecure, and only 1.1% were food secure. The higher prevalence of HHFI using the Household Food Insecurity Access Scale suggest that the use of the Household Hunger Scale categories made it possible to hone in on the most food insecure participants for analyses.

Calculating the prevalence of HHFI in our study according to the Household Food Insecurity Access Scale also permits comparisons to previous studies among HIV-infected populations in Uganda. The prevalence of severe food insecurity was 41.0% among 228 ARV-naive HIV-infected adults in Mbarara [48]. Among 902 HIV-infected adults receiving food aid from the World Food Program in Gulu and Soroti, 66.1% were found to be severely food insecure using the Household Food Insecurity Access Scale [38]. In sum, the prevalence of severe food insecurity was highest in our cohort.

Maternal anthropometric indices in this cohort reported here and elsewhere [49] suggest that women were thin when they enrolled in the study and that GWG was grossly inadequate. Nonetheless, MSHH was associated with BMI in univariate models but did not predict maternal BMI or GWG in multivariate models.

The proportion of women EBF at 6 months and any BF at 12 months was 66.4% and 80.0% respectively, which suggests that even in the context of excellent clinical care, the use of cART and regular counseling, infant feeding practices were sub-optimal. Indeed, our findings can be used to target infant feeding counseling messages to encourage women to refrain from those foods fed earliest (water, porridge, etc.) until after 6 months. Although sub-optimal, EBF practices in this population were closer to recommendations than those observed in other Ugandan studies. For example, the prevalence of EBF at 4-5 months from the nationally representative 2011 Ugandan Demographic and Health Survey was only 39.0% (prevalence at 6 months not presented) [50]. A 2005 study of 720 mother-child pairs in Hoima (HIV status not described) estimated the median duration of EBF to be 3.5 months, compared to 6.4 months in our study [51]. Most published studies of infant feeding practices among HIV-infected Ugandan women took place prior to the adoption of the 2010 WHO guidelines [52-55] and prior to implementation of universal cART among pregnant and breastfeeding women. Of the 8 studies of infant feeding practices among women receiving cART elsewhere [56], none report the prevalence of EBF at 6 months, and the follow-up in all but 2 is less than 12 months. As such, previously published infant feeding data among HIV-exposed infants are not readily comparable to ours.

Overall, household hunger was not associated with the duration of exclusive breastfeeding or any breastfeeding, except women with MSHH were significantly more likely to cease EBF between 4 and 6 months (HR 2.52) than other more food secure women who were still EBF. We had expected to find a stronger association between household hunger and infant feeding practices based on earlier qualitative work with PROMOTE participants. In semi-structured interviews with 32 lactating women, insufficient nutritional intake was frequently cited as a reason for not adhering to infant feeding recommendations, and 75% expressed concern about adequate breast milk production [57].

Of the three studies assessing the association between HHFI and infant feeding practices to date [20-22], this study found the strongest relationship between HHFI and EBF. No significant relationship between HHFI and EBF was found at any age in studies among 1343 infants in rural Bangladesh [21] or among 201 infants less than 6 months old in low-income urban households in the US [20]. A study of beliefs and attitudes towards EBF among 150 HIV-infected and -uninfected Kenyan women suggest that women experiencing HHFI were more likely to have reduced capacity to EBF, although actual BF practices were not assessed [22]. Further work is needed to better understand these relationships.

As for the quality of complementary foods, we had hypothesized that infants in households experiencing MSHH would receive poorer quality complementary foods, i.e. animal source foods later or less frequently. This was based on observations of inferior complementary foods in food insecure households in Bangladesh compared to more food secure households [58]. However, we found no significant differences in quality of complementary foods by household hunger status in our study.

There are several reasons why a strong relationship between household hunger, maternal nutritional status, and infant feeding was not detected. We may not have fully captured other important determinants of maternal nutritional status or infant feeding practices [59-61]. For example, literacy, marital and employment status and maternal psychosocial status, e.g. depression were not assessed, all of which can affect maternal nutritional status and infant feeding practices. Information about individuals' knowledge and beliefs about optimal infant feeding, support for infant feeding (material, such as help with household work and non-material, such as encouragement), and physiological ability to feed infants per recommendations would also have been useful for further elucidating the relationships between household hunger, maternal nutritional status, and infant feeding practices.

A second explanation may lie with the measurement of HHFI. HHFI was measured only once, during the most food secure time of year, while maternal nutritional status and infant feeding occurred over many months. This means that variation in food security is unmeasured and that the temporality of measurement of HHFI vs. other outcomes permits only conclusions about correlation and not causation. Third, social desirability reporting may have led to over-reporting of optimal BF practices. Fourth, the excellent clinical care and nutritional counseling provided as part of the trial might have reduced the effects of MSHH that would have been apparent with less intensive ante- and post-natal care. Lastly, the study might have been underpowered. For example, with the current sample size and prevalence of EBF at 6 months, our power to detect difference in proportions by MSHH was only 0.5. Differences in BMI and total GWG by MSHH that were trending towards significant ($p=0.08$ for BMI, $p=0.09$ for total GWG) might have reached the $p \le 0.05$ threshold with a larger sample size.

In summary, we found MSHH and severe food insecurity to be highly prevalent among HIV-infected pregnant women receiving cART in rural Uganda. Moderate to severe household hunger was not associated with maternal nutritional status in multivariate models, though women in households experiencing MSHH were less likely to EBF between 4 and 6 months compared to their more food secure counterparts.

Because food insecurity, HIV, poor maternal nutritional status, and sub-optimal infant feeding practices are highly prevalent and contribute substantially to morbidity and mortality in sub-Saharan Africa [62, 63], the causal relationship among these phenomena must be further explored. Specifically, the identification of any modifiable factors that impair maternal nutritional status or shorten the duration of EBF could have a substantial impact on the growth, development and overall health of HIV-exposed, uninfected infants, a growing and increasingly important population in sub-Saharan Africa.

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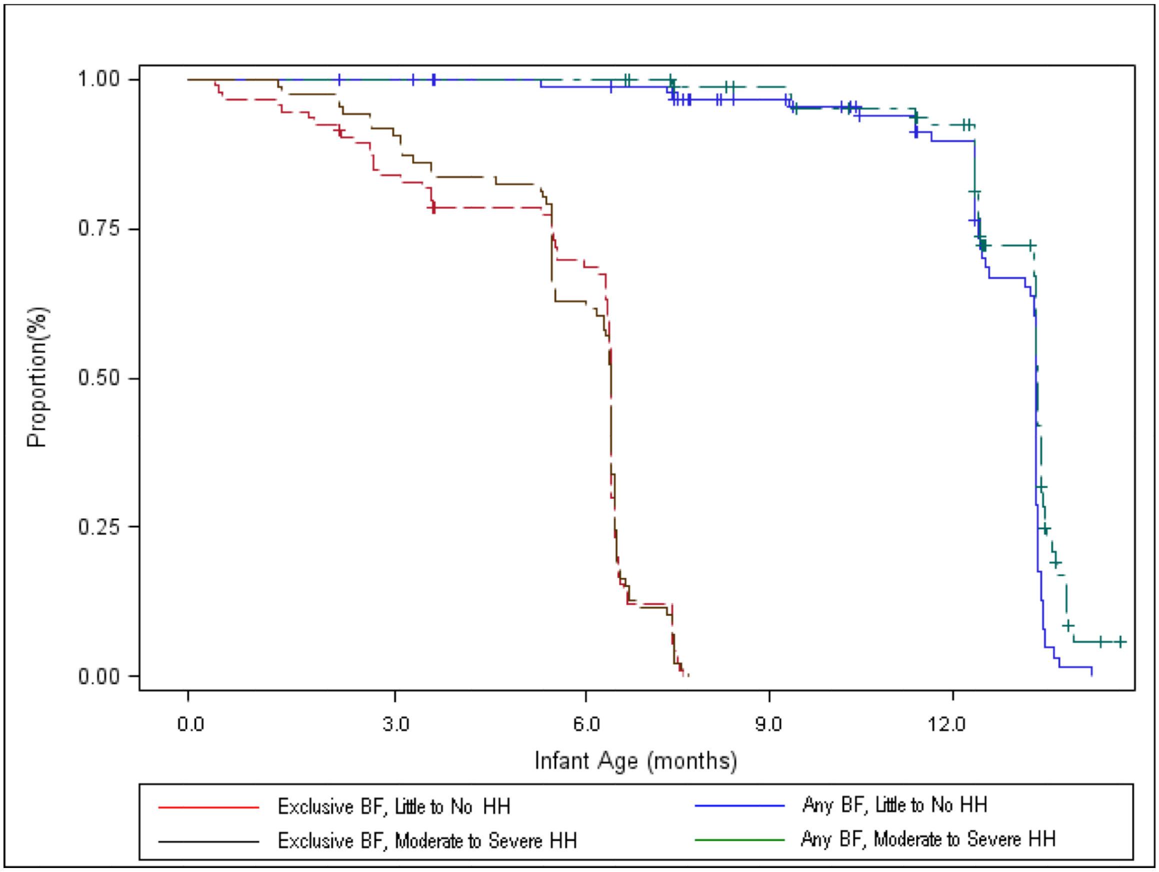

Figure 1.

Survival curves of exclusive and any breastfeeding by household hunger status among infants born to HIV-infected women receiving HAART in rural Uganda (n=180)

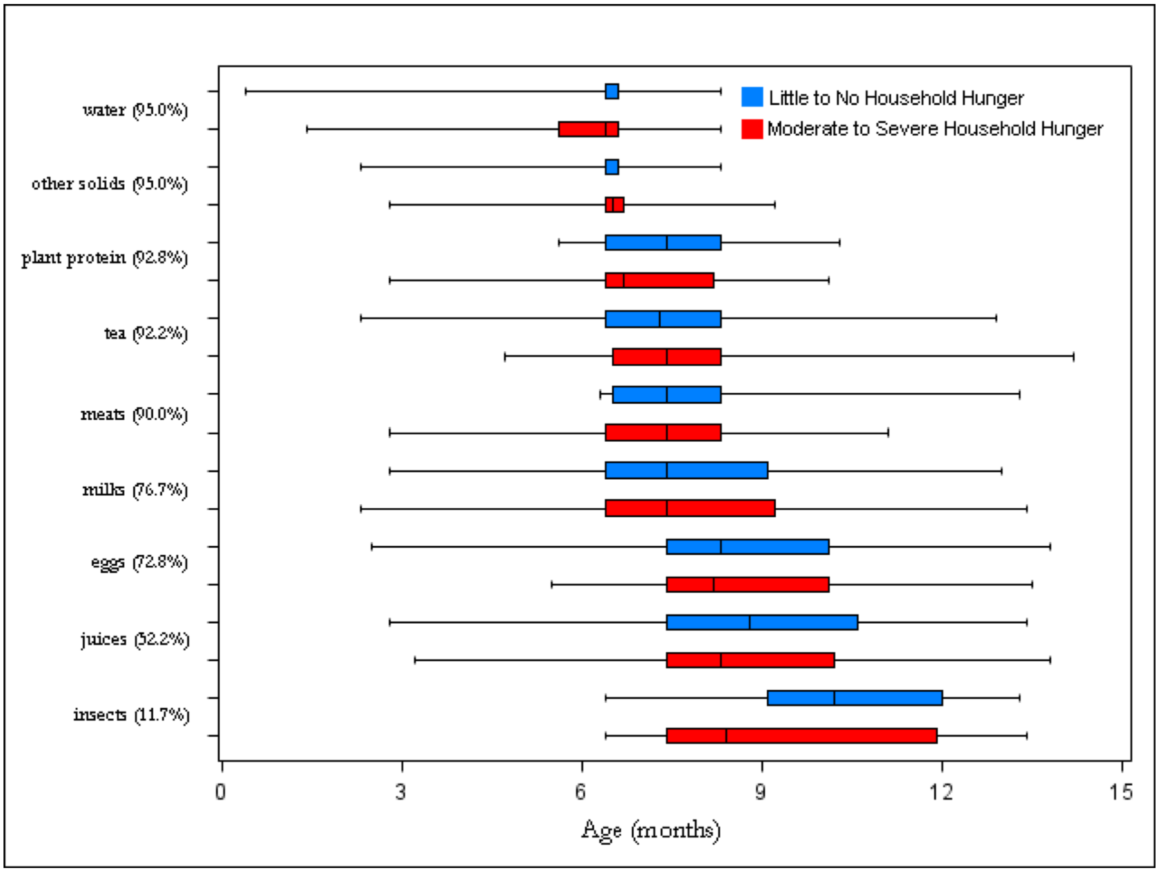

Figure 2.

Median and interquartile range of age in months at introduction of non-breast-milk foods among infants born to HIV-infected women receiving cART in rural Uganda, in descending order of frequency. Proportions indicate number of infants ever fed item.

Table 1

Baseline demographic and health characteristics of women at study enrollment, by category of household hunger (n=180)[1*]

	Moderate to Severe Household Hunger	**Little to No Household Hunger**	**Overall**
	n=86 (47.8%)	**n=94 (52.2%)**	**n= 180**
Age (years), Median (IQR)	29.0 (24.0, 34.0)	29.5 (26.0, 33.0)	29.0 (25.0, 33.0)
Gestational age (weeks), Mean (SD)	20.9 (4.4)	21.1 (4.2)	21.0 (4.3)
Gravidity, Mean (SD)	4.7 (2.2)	4.6 (2.1)	4.7 (2.1)
Primigravid [n (%)]	6 (7.0%)	7 (7.5%)	13 (7.2%)
Number of living children, Mean (SD)	3.0 (1.8)	2.9 (1.7)	3.0 (1.8)
Household size, Median (IQR) (n=171)	5.0 (3.0, 6.0)	5.0 (3.0, 6.0)	5.0 (3.0, 6.0)
Years since last birth, Mean (SD)	3.4 (2.5)	4.0 (2.6)	3.7 (2.6)
Education, [n (%)]			
Less than primary	71 (82.6%)	75 (79.8%)	146 (81.1%)
Primary or more	15 (17.4%)	19 (20.2%)	34 (18.9%)
Urban Residence (n=170)	16 (20.3%)	17 (18.7%)	33 (19.4%)
Bednet at Home (n=177)	83 (96.5%)	94 (100%)	177 (98.3%)
High Household Assets[2] (n=171)	12 (14.6%)	21 (23.6%)	33 (19.3%)
HIV diagnosis received during index pregnancy	37 (43.0%)	35 (37.2%)	72 (40.0%)
WHO Stage , [n (%)]			
Stage 1	84 (97.7%)	91 (96.8%)	175 (97.2%)
Stage 2	2 (2.3%)	3 (3.2%)	5 (2.8%)
Stage 3	0 (0%)	0 (0%)	0 (0%)
CD4 cell count, [n (%)] (n =177)			
<200	14 (16.9%)	8 (8.5%)	22 (12.4%)
200-350	23 (27.7%)	30 (31.9%)	56 (29.9%)
>350	46 (55.4%)	56 (59.6%)	102 (57.6%)
Log(10) Viral Load, Mean (SD) (n=177)	4.1 (0.9)	4.2 (0.9)	4.2 (0.9)
Hb, Mean (SD)	10.9 (1.2)	11.0 (1.2)	11.0 (1.2)
Anemia, Hb <11, [n (%)]	42 (48.8%)	40 (45.5%)	82 (45.6%)

IQR: Interquartile range

SE: standard error

BMI: Body mass index (kg/m2)

[*] No significant differences found at p≤0.05

[1] Data are from entire sample unless otherwise noted.

[2] A dichotomized score based on principal components analyses, see text.

Table 2

Anthropometric indices during pregnancy, by category of household hunger (n=180)[1]

	Moderate to Severe Household Hunger	Little to No Household Hunger	p-value
	n=86 (47.8%)	**n=94 (52.2%)**	
Weight in kg at enrollment*, Median (IQR)	**54.5 (48.0, 59.5)***	**56.3 (53.0, 62.0)**	0.01
Height in cm, Median (IQR)	161.0 (157.0, 164.0)	161.0 (157.0, 165.0)	0.71
BMI at enrollment, Mean (SD)	**21.3 (2.6)***	**22.5 (3.0)**	< 0.01
Mean BMI at 7 months*, Mean (SD) n=177	**21.9 (2.7)***	**22.9 (2.9)**	0.02
BMI at delivery, Mean *(SD)	**22.6 (2.7)***	**23.8 (3.1)**	< 0.01
Weekly GWG, Mean (SD)	0.18 (0.20)	0.21 (0.25)	0.27
Total GWG, Mean (SD)	3.2 (3.1)	3.4 (3.8)	0.47
% of participants with net weight loss between enrollment and delivery	9.3%	10.6%	0.77

* significantly different (p<0.05)

[1]Data are from entire sample unless otherwise noted.