Published in final edited form as:

J Acquir Immune Defic Syndr. 2014 December 15; 67(5): 569–572. doi:10.1097/QAI.0000000000000352.

Deficiencies of macronutrient intake among HIV-positive breast-feeding women in Dar es Salaam, Tanzania

Faith Kim¹, Nyasule Majura Neke, MD², Kristy Hendricks, PhD¹, Joyce Wamsele, MD², Zohra Lukmanji, PhD², Richard Waddell, DSc¹, Isaac Maro, MD, MPH², Ruth Connor, PhD¹, Todd Mackenzie, PhD¹, Mecky Matee, MD², Muhammad Bakari, MD, PhD², Kisali Pallangyo, MD², and C. Fordham von Reyn, MD¹

¹Geisel School of Medicine at Dartmouth and Dartmouth-Hitchcock Medical Center, New Hampshire, USA

²Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania

Abstract

We compared macronutrient intake, food insecurity and anthropometrics in breast feeding women: 40 HIV-positive women not yet on antiretroviral therapy and 40 HIV-negative women. Calculated deficits at 2 weeks were 517 kcal/d for HIV-positive women vs 87 kcal/d surplus for HIV-negative women ($p = 0.01$) and 29g protein/d for HIV-positive women vs 16g protein/d for HIV-negative women ($p = 0.04$). Food insecurity scores were 11.3 for HIV-positive women vs 7.8 for HIV-negative women ($p < 0.01$). Enhanced dietary education together with macronutrient supplementation may be required to improve health outcomes in HIV-positive women and their infants.

Keywords

HIV-positive; breast-feeding; nutrition

Introduction

Nutritional deficiencies are common among HIV-infected adults living in resource- poor regions and may affect adherence to anti-retroviral therapy (ART) and overall health outcomes (1). Breastfeeding imposes additional metabolic demands on HIV-infected women and if these are not met with increased nutrient intake there may be health consequences for both mother and infant.

Studies on HIV-infected breastfeeding women from South Africa have documented deficiencies in micronutrients, decreased serum albumin, in addition to diminished post-partum weight gain and triceps skinfold thickness compared to HIV-uninfected breastfeeding women (2, 3). However, only one other study from sub-Saharan Africa has have quantified dietary energy and protein intake in HIV-infected breast-feeding women to determine whether dietary macronutrient deficiencies also exist and may play a role in the health of these women (4).

We conducted a pilot study of nutritional intake, food insecurity and anthropometrics among HIV positive breastfeeding women and a group of HIV-negative controls in Tanzania who did not meet a standard definition of malnutrition (BMI <18.5 kg/m²) to determine the need for a trial of protein-calorie supplementation in HIV-infected breastfeeding women.

Methods

Subjects

HIV-positive and HIV-negative women 18 years old were screened at two antenatal clinics in Dar es Salaam, Tanzania during their last trimester. Eligibility required that the woman be free of acute illness and intend to exclusively breastfeed her infant for at least 3 months. Eligibility also required a BMI ≥18.5 kg/m² and that HIV-positive patients were not currently on or qualified for long-term anti-retroviral therapy (ART) and had a CD4 count ≥250 cells/uL. Short term ART for prevention of mother-to-child transmission was a standard of care, was prescribed for all women in this study, and did not affect eligibility. Women who delivered twins or who did not initiate immediate breastfeeding due to Caesarian section or infant mortality were excluded from further evaluation.

Screening visit

After informed consent, subjects were interviewed to obtain socio-demographic information including age, residence, financial and employment status of both the patient and her partner, highest level of education, income spent specifically on food, and number and ages of persons living in the same household.

Home visit at 2 weeks

All subjects with live infant births had a home visit performed within 2 weeks of delivery at a time when they had commenced breast-feeding. Subjects were interviewed for dietary intake and food insecurity (see below). Weight (kg), height (cm), skin fold thicknesses (mm) at five different areas including the triceps, subscapular, suprailiac, abdomen, and thigh as well as circumferences (cm) around the mid-upper arm, waist, hip, and thigh were determined by one of 3 three trained observers using calibrated Lange skinfold calipers and a Gulick II, non-stretch, pliable tape measure (5).

Phlebotomy was performed for HIV testing and CD4 count. HIV-negative subjects were required to have two negative HIV ELISA tests for HIV and HIV positive subjects were required to have two positive HIV ELISA tests. Women who tested positive and were unaware of their current HIV status were provided ELISA results, CD4 results, appropriate counseling, and referred to a Ministry of Health Care and Treatment Center (CTC) if not already under care. Subjects with a discordant ELISA results (one positive, one negative) were not eligible and referred to a CTC for further testing.

Clinic visit at 6 weeks

All subjects were scheduled for a follow-up visit 6 weeks post-partum at a time when they were still breastfeeding. Subjects were re-interviewed for dietary intake. Anthropometrics were not repeated.

Dietary assessment

At the time of 2 week and 6 week visits trained research nutritionists or study nurses evaluated dietary intake using a multiple pass 24-hour dietary recall to list all beverages and foods consumed in the previous day (6) Multiple passes by the interviewer probed for food preparation and missed food items; standardized food models were used to determine portion size. Energy and protein intakes were then calculated and recorded for each of the two dietary evaluations utilizing the Tanzania Food Composition tables (7). Nutritional education and counseling based on distinct World Health Organization (WHO) and Tanzanian Ministry of Health National Guidelines for HIV-positive and HIV-negative women, were provided based on the 2 week dietary evaluation (8).

Food insecurity

All subjects were administered the Household Food Insecurity Access Scale (HFIAS), which was adapted from the Food and Nutritional Technical Assistance II Project (FANTA-2) to determine availability and accessibility of food in each woman's household (9). An adapted questionnaire contained a total of nine yes or no questions followed by a "frequency-of-occurrence" question. Some questions inquired about the subject's perception of food vulnerability while other questions addressed the subject's behavioral responses due to food insecurity. Based on the answers given by the client, a score was assigned to each woman ranging from 0 (no insecurity) to 27 (maximum insecurity).

Data analysis

The study dietitian entered data into a Microsoft Excel sheet to perform analyses. Calorie deficits were calculated based on recommendations of the World Health Organization (WHO) for breastfeeding women with added requirements for HIV-positive subjects; protein calculations were based on 12% of kcal. For HIV-negative breast-feeding women WHO recommends 2640 kcal/d, thus 79 g protein/d (based on 12% of kcal) (10, 11). For HIV-positive breast-feeding women, WHO recommends an additional 10 % increase in energy intake or 2854 kcal/d, thus 86 gm/protein/d (based on 12% of kcal) (12, 13). Differences between groups were evaluated using a two-tailed t-test. P values < 0.05 were considered statistically significant. The association between food insecurity and energy and protein intake was assessed using Spearman correlations.

Ethical approval

The study was approved by the Institutional Review Board at Geisel School of Medicine at Dartmouth and the Research Ethics Committee of the Muhimbili University of Health and Allied Sciences (MUHAS).

Results

Subject characteristics

A total 111 HIV-positive were screened in their third trimester to obtain 40 women eligible for study entry. Ineligible HIV-positive women included 53 subjects who could not be located 2 weeks after delivery, 4 with CD4<250, 5 twin deliveries, 2 C-sections, 4 infant

deaths and 2 other. A total of 83 HIV-negative women were screened to obtain 40 women eligible for study entry. Ineligible HIV-negative women included 22 subjects who could not be located 2 weeks after delivery, 2 twin deliveries, 7 C-sections, 10 infant deaths and 2 other.

Eligible HIV-positive women included in the study were older and had higher food insecurity scores than eligible HIV-negative women but other characteristics were similar between the two groups including the amount spent on food each day. Most patients were married, had only elementary education and were unemployed (Table 1). For HIV-positive women the median CD4 count was 571 cells/uL.

Body composition

Data from 2 weeks after delivery are shown in Table 2. Although all values were lower in HIV-positive women than HIV-negative women the differences were not significant. Mid upper arm circumference was <27 cm in 18 (45%) HIV-negative women and in 25 (63%) HIV-positive women ($p = 0.08$).

Calorie and protein intake

Data from 2 weeks and 6 weeks after delivery are shown in Table 2. At 2 weeks there was a trend toward lower Kcal intakes in HIV positive women and both groups had deficits in protein intake. At 6 weeks energy and protein intakes were significantly lower than intakes at 2 weeks in HIV negatives ($p = 0.03$ and 0.03 respectively). At 6 weeks energy and protein intakes were not significantly lower than intakes at 2 weeks in HIV positives ($p = 0.93$ and 0.29 respectively).

At 2 weeks recommended energy and protein intakes were met by 22% of HIV positive women and 37% of HIV negative women ($p = 0.22$). Recommended protein intakes were met by 15% of HIV positive and 22% of HIV negative women ($p = 0.57$). There were no significant correlations between energy or protein intake with Food Insecurity in HIV positive women ($p = 0.19$ and 0.14 respectively) or HIV negative women ($p = 0.55$ and 0.48 respectively).

Among HIV-positive subjects lost to follow-up at 6 weeks there was no significant difference in baseline age, CD4 or BMI compared to subjects not lost to follow-up (data not shown). Among HIV-negative subjects lost to follow-up there was no significant difference in baseline age or BMI compared to subjects not lost to follow-up (data not shown).

Discussion

In the present study we have shown that lactating HIV-positive women living in Dar es Salaam Tanzania who did not meet a standard definition of malnutrition have significant deficits in recommended energy and protein intake and that these deficits increased between 2 and 6 weeks after delivery. HIV-negative women had deficits in recommended protein intake at 2 weeks after delivery and deficits in both energy and protein at 6 weeks. Although observed differences in intake did not differ between the two groups, calculated deficits

were significantly higher in the HIV positive women due to our use of higher WHO recommendations for intake in HIV positive women.

A study of lactating women from the largely rural KwaZulu Natal Province in South Africa has shown that 84% of HIV-positive women and 48% of HIV-negative women have reduced albumin as well as low levels of vitamin B12, folate, alpha-tocopherol, ferritin and zinc (3). A second study in HIV positive and negative lactating women from this same region used multiple dietary recalls and showed even lower energy and protein intakes than observed in our study (4). This suggests that macronutrient deficiencies may be common in lactating HIV-positive women in many regions of sub-Saharan Africa.

The deficits we observed have important implications for maternal health and, potentially for the health of infants born to these breastfeeding mothers. Breastfeeding reduces infant mortality in both HIV-positive and HIV-negative infants (14). Though research is limited, current data suggests optimal nutritional status of the HIV-positive mother improves health outcomes of the mother and survival of the infant (9).

The women in this study did not meet a standard definition of malnutrition. Although nutritional supplementation is indicated for lactating women who are malnourished our findings suggest that dietary counseling and nutritional supplementation may also be indicated for many HIV-positive and some HIV-negative women living in urban areas of sub-Saharan Africa.

Our study has several limitations due to its small sample size and the loss of 20% of subjects between the 2 week and 6 week visits. Thus, the findings may not be broadly representative. Twenty-four hour dietary recall is the recommended method to assess dietary intake in this setting, but estimates only one day's intake and may not reflect average daily intake (11). Further, the present study was not designed to assess infant outcomes, breast milk quality or long term maternal health. Thus, we are unable to determine whether the deficiencies we observed had effects on health outcomes.

In summary we found substantial deficiencies in dietary energy and protein intake compared to recommendations for lactating HIV-positive women, and, to a lesser extent, lactating HIV-negative women in Tanzania. Controlled trials are indicated to assess the potential benefits of a protein-energy supplement for lactating HIV-positive women in sub-Saharan Africa.

Acknowledgments

Funding: National Institutes of Health, 1R01HD057614 and Fogarty International Center, D43-TW006807

The authors wish to thank the Tanzanian women who volunteered for this study and the staff of the DarDar Program who participated in the study.

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Table 1

Subject characteristics

	HIV- (n = 40)	HIV+ (n = 40)
Age, Median (range)*	26 yrs (19–38)	30 yrs (21–42)
Education		
None	8	8
Primary	25	28
Secondary	7	4
Marital Status		
Single	1	7
Married	38	32
Divorced	1	1
Occupation		
Paid Occupation	5	4
No Paid Occupation	30	20
Petty Business	5	16
People in Household		
Number, Median (range)	3 (1–11)	4 (1–12)
Number < 7 yrs, Median (range)	1 (1–4)	1 (1–3)
Food Expense/Day, Median (\$ US)	3.3 (1.3–8.3)	3.3 (1.9–9.2)
Food Insecurity score (mean)	7.8	11.3**
Median CD4 Count (25–75%) in cells/μL	N/A	571 (444–746)

* p = 0.0004;

** p < 0.01

Table 2

Body composition and dietary intake at 2 and 6 weeks after delivery

	HIV–	HIV+	P
BODY COMPOSITION (2 weeks)	N=40	N=40	
Weight kg, mean (range)	63.0 (45.0–82.0)	57.0 (46.0–97.2)	0.39
BMI kg/m ² , mean (range)[SD]	25.0 (20.9–30.3) * [4.0]	24.4 (18.5–37.3) [2.3]	0.30
BMI 18.5–24.9	17	22	
BMI 25–29.9	14	14	
BMI ≥30	1	4	
MUAC cm, mean (range)	23.5 (21.7–27.0)	26.1 (21.5–34.2)	0.08
Triceps skin fold thickness mm, mean (range)	20.2 (10.3–31.0)	18.0 (5.3–41.5)	0.25
DIETARY INTAKE (2 weeks)	N=40	N=40	
<i>Calories (kCal, mean)</i>			
Recommended	2640	2854	-
Observed (25–75%) [SD]	2727 (2140–2981) [1085]	2337 (1787–2761) [785]	0.07
Deficit	NA	517	0.01
Surplus	87	NA	
<i>Protein (g, mean)</i>			
Recommended	79	86	-
Observed (25–75%) [SD]	63 (44–74) [33]	57 (39–69) [22]	0.30
Deficit	16	29	0.04
DIETARY INTAKE (6 weeks)	N= 27	N=32	
<i>Calories (kCal, mean)</i>			
Recommended	2640	2854	-
Observed (25–75%) [SD]	2338 (1757–3010) [792]	2168 (1745–2468) [803]	0.42
Deficit	302	686	0.01
<i>Protein (g, mean)</i>			
Recommended	79	86	-
Observed (25–75%) [SD]	52 (40–57) [20]	50 (37–57) [19]	0.73
Deficit	27	36	.10

MUAC: Mid Upper Arm Circumference; BMI: Body Mass Index,

*
n = 32