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ORIGINAL PAPER

Sexual Relationship Power and Malnutrition Among HIV-Positive Women in Rural Uganda

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Abstract Inequality within partner relationships is associated with HIV acquisition and gender violence, but little is known about more pervasive effects on women's health. We performed a cross-sectional analysis of associations between sexual relationship power and nutritional status among women in Uganda. Participants completed questionnaires and anthropometric measurements. We assessed sexual relationship power using the Sexual Relationship Power Scale (SRPS). We performed logistic regression to test for associations between sexual relationship power and poor nutritional status including body mass index, body fat percentage, and mid-upper arm circumference. Women with higher sexual relationship power scores had decreased odds of low body mass index (OR 0.29, $p = 0.01$), low body fat percentage (OR 0.54, $p = 0.04$), and low mid-upper arm circumference (OR 0.22, $p = 0.01$). These relationships persisted in multivariable models adjusted for potential confounders. Targeted interventions to improve intimate partner relationship equality should be explored to improve health status among women living with HIV in rural Africa.

keywords Gender Equality · Malnutrition · HIV/AIDS · Sub-Saharan Africa

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Introduction

Women are disproportionately affected by the HIV epidemic, especially in sub-Saharan Africa (SSA), where 60% of the 23 million people living with HIV/AIDS (PLWHA) are female [1]. There is considerable interest in the increased risk of HIV acquisition in women [2–7], and interventions to mitigate this risk [8, 9]. Multiple studies have shown that gender inequality and relationship power imbalances are associated with risky sexual behavior, sexual violence, and HIV acquisition [10–13]. However, there is little known about how relationship power differentials affect health among women already infected with HIV in resource-limited settings (RLS).

A major contributor to poor health among PLWHA is malnutrition [14–17], which is often attributed to the effects of advanced AIDS. Gender-based disparities in nutritional status have been noted in epidemiologic studies. For example, recent ecologic studies have noted stagnant or decreasing height in women in SSA [18, 19]. Several authors hypothesize that these findings are related to gender inequality in RLS. Consistent with this hypothesis, an analysis of demographic health surveys from women in three SSA countries documented a relationship between diminished autonomy and risk of chronic energy deficiency

[20]. While these preliminary data suggest that gender power disparities may contribute to increased risk of malnutrition among women in SSA, no studies to date have directly examined associations between sexual relationship power and malnutrition. Because both intimate partner violence and malnutrition are prevalent among HIV-infected women [21–24], such an association is particularly likely to affect HIV-positive women. We sought to assess the relationship between low sexual relationship power and malnutrition in a sample of HIV-positive women in rural Uganda.

Methods

We performed a cross-sectional analysis among HIV-positive women enrolled in the Uganda AIDS Rural Treatment Outcomes (UARTO) cohort, an ongoing study of HIV medication adherence that began in 2005. Subjects attend clinic quarterly for CD4 count and viral load measurements, and structured interviews to obtain data on socio-demographic characteristics. Beginning in September 2007, a substudy of UARTO collected detailed information on food insecurity, gender empowerment, and nutritional status, as measured by anthropometric indicators including height, weight, mid-upper arm circumference, and body impedance analysis. Informed consent was obtained for all participants. The Institutional Review Boards of the Mbarara University of Science and Technology, University of California, San Francisco, and Partners Healthcare approved the study. The study was performed in accordance with the Helsinki Declaration of 1975, as revised in 2000.

We conducted a cross-sectional analysis of associations between sexual relationship power and malnutrition at baseline of the sub-study. For our outcome variables, we defined malnutrition based on conventional cutoffs, as low body mass index (BMI) <18.5 kg/m^2, low body fat percentage (BFP) <25%, and low mid-upper arm circumference (MUAC) <22 cm.

The primary explanatory variable of interest was sexual relationship power, which we measured using the sexual relationship power scale (SRPS). The scale was developed with focus groups to ascertain key elements of sexual empowerment [25], and has been validated and used in both resource-rich and resource-poor settings [10, 11, 26, 27]. The scale is divided into two sub-scales: relationship control (RC) and decision-making dominance (DMD), which are comprised of fourteen and eight questions respectively. The two sub-scale scores are combined with equal weighting into an overall SRPS score, which ranges from 1–4. Higher scores correspond to greater sexual relationship power. We controlled for socioeconomic and clinical characteristics that might influence nutrition and/or dynamics of intimate partner relationships including age, literacy, educational attainment, marital status, household size, household wealth, ART use at time of study, and CD4 count nearest to the survey visit. To adjust for household wealth, we created a linear index of asset ownership and household dwelling characteristics using the methodology explained by Filmer and Pritchett [28].

We fitted univariable logistic regression models to the data to determine which explanatory variables were associated with our three outcome measures of malnutrition. Variables associated with malnutrition in unadjusted analyses as determined by a p-value <0.25 were retained in adjusted models [29]. To ascertain which sub-scale of SRPS could be influencing our results, we further fitted regression models using the RC and DMD sub-scale scores as explanatory variables. Finally, to facilitate magnitude of association comparisons across covariates, we fitted explanatory variables to multivariable linear regression models of our three nutritional outcomes. We did this to compare corresponding regression coefficients to a one-point change in SRPS score.

Results

A total of 307 out of 325 (94.5%) women in the UARTO cohort completed the SRPS survey. The median age of the sample was 33 years (IQR 28–38, Table 1). At the time of the survey, median CD4 cell count was 207 cells/ml (IQR 138–303) and 53% had not yet initiated ART. Approximately 77% had a primary education or lower, 81% were literate and 38% were married.

Median BMI of the study population was 22.6 kg/m^2 (IQR 20.2–25.2). The prevalence of underweight as determined by BMI less than 18.5 kg/m^2 was 7.0%, which is similar to prior estimates among HIV + women in SSA [21]. A description of study characteristics subdivided by BMI status is shown in Table 1. Prevalence of malnutrition as measured by low BFP and low MUAC were 18.5, and 4.3% respectively.

Median BMI in the lowest, middle, and highest tertile of SRPS scores was 22.3, 22.7, and 23.8 kg/m^2. Median BFP and MUAC among the tertiles from lowest to highest was 31.4%, 32.2%, 33.0% and 26.4, 27.0, and 27.1 cm respectively.

In unadjusted logistic regression modeling, each one-point increase in the SRPS was associated with decreased odds of low BMI (OR 0.29, $p = 0.01$), low BFP (OR 0.54, $p = 0.04$), and low MUAC (OR 0.22, $p = 0.01$), (Table 2a–c). In adjusted regression modeling including covariates that met criteria in univariable model by p-value <0.25, increased SRPS remained significantly associated with decreased odds of low BMI (AOR 0.31, $p = 0.01$) and

Table 1 Summary indicators for cohort of HIV-positive women in rural Uganda

Variable	Total cohort ($n = 307$)	BMI $\leq$ 18.5 ($n = 21$)	BMI > 18.5 ($n = 268$)	Test statistic	p value
Sexual relationship power score					
Median (range)	2.5 (1.2–3.9)	2.2 (1.2–3.0)	2.5 (1.2–3.9)	$Z = 2.51^a$	0.01
Age, median (IQR)	33 (19–75)	33 (20–64)	33 (28– 38)	$t = 0.71^b$	0.24
CD4 Count, median (IQR)	207 (138–303)	183 (122–302)	207 (142–304)	$Z = 0.66^b$	0.51
CD4 Category (%)	12.6	19.1	12.1	$\chi^2 = 1.10^c$	0.78
<100	50.3	42.9	50.6		
100–249	31.0	33.3	30.9		
250–500	0.1	4.8	6.4		
>500					
ART use at baseline (%)	47.6	33.3	47.8	$\chi^2 = 1.63^c$	0.20
Education (%)				$\chi^2 = 0.38^c$	0.83
None	18.9	14.3	19.7		
Primary	58.0	61.9	56.8		
Secondary or greater	23.2	23.8	23.5		
Literate (%)	81.1	85.7	79.6	$\chi^2 = 0.46^c$	0.50
Married (%)	38.7	40.1	23.8	$\chi^2 = 2.18^c$	0.14
Household size, median (range)	3 (0–14)	3 (0–13)	3 (0–14)	$Z = 1.27^a$	0.20
Asset index, (range)	-0.3 (-1.5–1.3)	-0.7 (-1.3–0.5)	−0.2 (−1.5–1.3)	$t = 0.83^b$	0.40
BMI (median, IQR)	22.6 (20.2–25.2)				
<18.5 (%)	7.0				
18.5–25	61.7				
>25	31.4				
Body fat percentage (median, IQR)	18.8 (14.0–24.5)				
Low body fat percentage <25 (%)	18.5%				
Mid-upper arm circumference (median, IQR)	26.8 (24.7–29.3)				
Low mid-upper arm circumference (<22)	4.3%				

Comparisons are made for sub-set of participants underweight by body mass index versus those with normal or high BMI

[a] Comparisons for non-normally distributed continuous covariates performed with rank-sum testing

[b] Comparisons for categorical variables by performed with χ^2 testing

[c] Comparisons for normally distributed continuous variables performed with studentized t testing

low MUAC (AOR 0.29, $p = 0.04$). The association for low BFP was not statistically significant (AOR 0.57, $p = 0.08$).

In multivariable linear regression modeling, each unit increase in SRPS score was associated with an increase of 1.0 kg/m^2 in BMI (95% CI 0.17–1.83, $p = 0.02$), a non-significant increase of 1.23% in BFP (95% CI −0.63–3.10, $p = 0.19$) and an increase in 1.08 cm in MUAC (95% CI 0.33–1.82, $p = 0.01$). The coefficients of association for SRPS were larger than for other predictors including CD4 count, household size, and socioeconomic status.

To ascertain which elements of the SRPS were most associated with malnutrition, we also used logistic regression to test the association between the RC and DMD sub-scales and our outcomes of interest. Increasing RC scores were significantly associated with low BMI (OR 0.26, $p < 0.01$) and low MUAC (OR 0.23, $p = 0.01$), but not low BFP (OR 0.51, $p = 0.07$). While individuals with higher DMD scores were less likely to be malnourished, associations were not statistically significant for any of the three indicators of malnutrition (OR for BMI 0.48, $p = 0.08$; OR for BFP 0.62, $p = 0.09$, OR for MUAC 0.63, $p = 0.09$). When both sub-scales were retained in the model along with predicted cofounders, the RC sub-scale remained statistically significantly associated with both low BMI (AOR 0.27, $p = 0.01$) and low MUAC (AOR 0.31, $p = 0.05$), while the estimated odds ratios for DMD were much closer to a null effect (for low BMI AOR 0.92, $p = 0.86$; for low MUAC AOR 0.72, $p = 0.79$).

Discussion

Although multiple studies have shown strong links between low sexual relationship power and both high-risk sexual

Table 2 Logistic regression model of association between BMI ≤18.5 Body Fat Percentage <25%, Low Mid-Upper Arm Circumference <22 cm and sexual relationship power among a cohort of HIV-positive women in rural Uganda

	Univariable model		Multivariable model ($n = 284$)		
	OR	*p* value	OR	95% CI	*p* value
a. BMI					
Sexual relationship power score	0.29	0.01	0.31	0.12–0.78	0.01
Age (per 10 years)	0.98	0.48	–		
CD4 count (per 100 cells/ml)	0.93	0.63	–		
ART use at baseline	0.55	0.21	0.79	0.29–2.13	0.64
Education (primary or greater)	1.47	0.55	–		
Literate	1.54	0.50	–		
Married	0.47	0.15	0.57	0.20–1.64	0.30
Household size	1.15	0.06	1.14	0.98–1.34	0.09
Asset index score	0.91	0.40	–		

	Univariable model		Multivariable model ($n = 268$)		
	OR	*p* value	OR	95% CI	*p* value
b. BFP					
Sexual relationship power score	0.54	0.04	0.57	0.31–1.06	0.08
Age	0.09	0.38	–		
CD4 Count (per 100 cells)	0.96	0.77	–		
ART use at baseline	1.13	0.68	–		
Education (primary or greater)	1.16	0.71	–		
Literate	0.90	0.79	–		
Married	1.01	0.97	–		
Household size	1.09	0.13	1.14	1.00–1.29	0.04
Asset index score	0.83	0.03	0.80	0.66–0.96	0.02

	Univariable model		Multivariable model ($n = 288$)		
	OR	*p* value	OR	95% CI	*p* value
c. MUAC					
Sexual relationship power score	0.22	0.01	0.29	0.09–0.94	0.04
Age (per 10 years)	1.41	0.29	–		
CD4 Count (per 100 cells)	0.62	0.08	0.71	0.41–1.22	0.21
ART use at baseline[a]	0.31	0.08	–		
Education (primary or greater)	0.50	0.26	–		
Literate	0.34	0.07	0.40	0.12–1.35	0.20
Married	0.27	0.09	0.35	0.07–1.66	0.28
Household size	1.09	0.35	–		
Asset index score	0.86	0.36	–		

BFP body fat percentage, *MUAC* Mid-upper arm circumference

[a] ART use at baseline was dropped from the multivariable model because of colinearity with CD4 count

behavior and HIV acquisition [10–13, 30], there is limited data describing the health effects of low sexual relationship power beyond sexual practices and condom use. Here we report a strong association between low relationship power and malnutrition in a sample of HIV-positive women in rural Uganda. The strength of the association persists across multiple measures of malnutrition including BMI, BFP, and MUAC; is only marginally diminished after adjustment for potential confounders of malnutrition; and is greater in magnitude compared to other known and predicted correlates of malnutrition in PLWHA including SES and CD4 count respectively [21]. Given the negative effects of malnutrition [14, 16, 31, 32] and food insecurity [33] among PLWHA, efforts to determine the causal pathway of this relationship will be an important step towards improving health outcomes and quality of life for HIV-positive women in RLS.

Our finding that relationship power is associated with nutritional risk is consistent with previous findings [34, 35]. Others have shown that women in RLS are often dependent on their partners for food [36], and that HIV-infected women are at greater risk for food insecurity [37]. Women are often the last in their household to eat, are distributed less nutritious foods [38], and can be particularly susceptible to malnutrition after perturbations in household income or drought [39–41]. Women who are victims of domestic violence are also at increased risk of malnutrition [42]. Women with low sexual relationship power thus might be more susceptible to a disadvantaged status in terms of intra-household food distribution. HIV-positive women are particularly susceptible to these effects because of their increased risk of both intimate partner relationship violence and malnutrition [12, 21–24]. Though further study is needed to corroborate this hypothesis, we postulate that the baseline vulnerability of HIV-positive women in RLS is exacerbated by unequal power in intimate relationships, leading to greater risk of malnutrition.

Increased efforts to study and implement interventions that ameliorate imbalances in intimate partner relationships in RLS should be prioritized. Multiple studies have sought to assess gender empowerment interventions and their effect on HIV prevention [43–45]. However, aside from reports describing significant reductions in intimate partner violence after economic empowerment interventions [46, 47], there are few interventions specifically designed to improve partner equality within intimate relationships of HIV-positive women, and no published reports on their efficacy. Therefore, there is a great need to further evaluate both existing and new interventions, and to expand the reach of successful programs. Given the findings described here, nutritional status indicators should be considered as outcomes of interest for such interventions.

While some previous studies found greater effects of DMD subscale scores on risky sexual behaviors [13], we found the association between malnutrition and sexual relationship power was stronger with the RC sub-scale. This difference might be explained by the distinct focus of the sub-scales. Whereas the decision making dominance sub-scale assesses issues relating to sexual risk (e.g. "Who usually has more to say about whether you have sex"), the relationship control sub-scale might be more targeted to intra-household gender inequality (e.g. "Most of the time, we do what my partner wants to do," and "My partner does what he wants, even if I do not want him to"). Thus, in keeping with our study hypothesis, the relationship control sub-scale might be a more sensitive predictor of malnutrition risk in this population.

This study has a number of limitations. The primary limitation of this analysis is its cross-sectional design, which precludes our ability to make causal inferences about the observed associations. For example, the reverse relationship might be true: malnutrition might lead to low sexual power if malnourished women are physically less dominant or perceive themselves to be so in sexual relationships. In contrast to most resource-rich settings, larger body types remain associated with wealth and power in some African cultures [48]. Thus malnutrition, primarily stemming from HIV or other attributable causes might consequently affect female empowerment in sexual relationships. Future longitudinal studies will lend further insight into the nature of this relationship. Additionally, the study was limited to women in rural Uganda with HIV, and therefore our results might not be generalizable to other populations.

In summary, sexual relationship power is strongly associated with malnutrition among HIV-positive women in rural Uganda. Further study is needed to explore the causal nature of this relationship and to identify interventions to improve female nutritional status and gender inequality in this especially vulnerable population.

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