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Context

The global scale-up of care and treatment for persons living with HIV has made antiretroviral therapy (ART) available in populations with higher prevalence of low nutritional status than in the populations in which efficacy and toxicity of antiretroviral agents were assessed in clinical trials. Rwanda's HIV treatment program strives to provide care and ART as indicated to all HIV-infected Rwandans.

The implications of malnutrition in HIV infection may differ in higher- and lower-income settings

- Poverty, food insecurity, hunger, and lack of food safety due to uncertain sanitation are greater in lower-income countries.
- Societal consequences of malnutrition include greater threats to the integrity of the labor force and local health care systems in developing countries.

- There has been little study of nutrition and HIV in lower-income countries
- The need to provide HAART to as many patients as possible, as quickly as possible, has confounded attempts to optimize therapy.
- Most nutritional studies have involved pregnant women and/or children.
- Limited studies have shown effects of food insecurity on treatment adherence (1) as well as associations between late stage disease, malnutrition, and poor outcome (2)

Specific Aim

To assess the association of pre-treatment body composition, serum markers and immune status on CD4 increase and viral load decline after initiation of ART

Methods

The Rwandan Women's Interassociation Study and Assessment (RWISA) is a prospective observational cohort study established by Women's Equity in Access to Care and Treatment (WE-ACTx Rwanda). RWISA enrolled 936 women in May-November 2005, 710 HIV+ and 236 HIV-negative, and is designed to assess the effectiveness and toxicity of ART and the influence of comorbidities in Rwandan women. A major aim of RWISA is to determine the factors affecting treatment response in this cohort, especially post-traumatic stress syndrome and depression.

All RWISA participants were ART-naïve at study entry. The RWISA enrollment visit included structured interview (to capture demographics, medical and psychosocial history), brief physical exam, collection of blood and cervical specimens, and body impedance analysis.

POPULATION: 710 ART naïve HIV+ Rwandan women, of whom 543 initiated ART

MEASUREMENTS:

- Height, Weight and BMI
- Bioelectric Impedance Analysis: body cell mass, fat mass, fat-free mass
- Waist and hip circumferences, waist-to-hip ratio (WHR)
- CD4 count at six-month intervals
- HIV-1 RNA before and after ART initiation (in 231 ART initiators)

Association of Pre-Treatment Nutritional Status with CD4 and Viral Load Response to Antiretroviral Therapy in Rwandan Women

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Results

Table 1: Baseline Demographic and Clinical Characteristics

	Initiated ART	Did not initiate ART	P-value
Number (n)	457	253	---
Median Age, years	34	34	0.6100
Body mass index, Kg/m ²	Median (IQR)	Median (IQR)	
	21.0 (19.0, 23.3)	21.0 (19.1, 24.0)	
Smoke cigarettes, %	2.6	2.4	0.84
Alcohol use, %			0.96
	None	78.3	
	1-3 drinks/day	21.3	
	>3 drinks/day	0.42	
Post-menopausal, %	5.4	5.78	0.48
Income, median US\$	\$16-60	\$16-60	0.87
Lifetime sexual partners	Median (IQR)	Median (IQR)	0.74
	3 (2, 6)	3 (2, 6)	
Education (%)			0.41
	None	21.81	
	Grade 1-6	70.92	
	Grade 7-11	6.77	
	Completed secondary	1.20	
Have enough food, % yes	14.13	15.77	0.90
CD4 count, cells/mm ³	Median (IQR)	Median (IQR)	<.0001
	208 (138, 287)	367 (286, 489)	
HIV-1 RNA, copies/mL (log ₁₀ U)	Median (IQR)	Median (IQR)	0.64
	4.55 (3.1, 5.0)	4.00 (3.1, 4.9)	
Serum albumin, g/dL	Median (IQR)	Median (IQR)	0.10
	3.43 (3.01, 3.80)	3.49 (3.09, 3.84)	
Hemoglobin, g/dL	Median (IQR)	Median (IQR)	<.0001
	13.0 (11.8, 14.6)	13.5 (12.7, 14.1)	
Total Body Fat, Kg	Median (IQR)	Median (IQR)	0.15
	12.1 (7.95, 17.3)	12.4 (7.85, 17.3)	
Fat free mass, Kg	Median (IQR)	Median (IQR)	0.12
	40.2 (37.1, 43.2)	40.6 (38.2, 43.6)	

Table 2: Change in CD4 count and HIV-1 RNA in HIV+ women

	Initiated ART	Did not initiate ART
Median follow-up, p, days	558 ¹	577
Self-reported adherence, mean %	99.39	---
Change, median (IQR)		
CD4, cells/mm ³	61 (2, 127)	-47 (-118, 12)
HIV-1 RNA copies/mL	-2.7 (-3.2, -0.7)	---
Non-responders %		
CD4 count	24.6	NA
HIV-1 RNA	20.5	NA

CD4 non-responder= no increase in CD4; HIV-1 RNA non-responder= no increase in HIV-1 RNA; ¹From immediate pre-HAART measurement to most recent available; ²n=251 in analyses of HIV-1 RNA, with med at follow-up 227 days on ART

Table 3: Univariate and Multivariate Predictors of CD4 Change from pre-ART to longest follow-up (N = 400)

Parameter	Univariate		Multivariate	
	Parameter Estimate	P-value	Parameter Estimate	P-value
Income	-13.2	0.010	-13.173	0.009
Nadir CD4, per 25 cells	-3.9	0.002	-3.477	0.008
Hemoglobin, per gm/dL	-5.6	0.033		
Education, per category	-8.37	0.145		
Pre-ART HIV RNA, per log ₁₀	12.4	0.20		
FFM, per Kg	-1.12	0.35		
Fat, per Kg	-0.60	0.44		
BMI, Kg/m ²	-2.01	0.19		
Albumin, per gm/dL	-8.61	0.43		

Table 4: Univariate and Multivariate Predictors of Change in HIV-1 RNA from pre-ART to longest follow-up (N = 229)

Parameter	Univariate		Multivariate	
	Parameter Estimate	P-value	Parameter Estimate	P-value
Body mass index, Kg/m ²	0.10	0.0005	0.005	0.99
Albumin, per gm/dL	0.56	0.0001	-0.07	0.55
Pre-ART HIV RNA, per log ₁₀	-0.94	<.0001	-0.9	<.0001
Total Body Fat, per Kg	0.037	0.114	0.002	0.93
Hemoglobin, per gm/dL	0.20	0.0004	-0.02	0.55
Nadir CD4, per 25 cells/mm ³	0.06	0.113	0.007	0.99
Income, per month	-0.08	0.56		
Fat Free Mass	0.02	0.34		
Education, per category	0.11	0.30		

References

1. Au JT *et al.* Access to adequate nutrition is a major potential obstacle to antiretroviral adherence among HIV-infected individuals in Rwanda. AIDS 2006;20:2116-2118.
2. Niyongabo T *et al.* Nutritional status of adult inpatients in Bujumbura, Burundi (impact of HIV infection). Euro J. of Clin. Nutri. 1999;53:579-582.

Summary

• Body mass index, fat free mass, total body fat, hemoglobin and serum albumin measured prior to ART initiation did not predict virologic or immunologic response, in multivariate models.

• The only significant predictors of greater CD4 increases on ART were lower pre-ART CD4 count, and lower income

• Changes in viral load were predicted only by pre-ART HIV-1 RNA

Conclusion

Measures of pre-treatment nutritional status in ART-naïve Rwandan women did not predict immunologic or virologic responses. This suggests that poorer pretreatment nutritional status, at least within the ranges of moderate malnutrition, does not prevent an excellent response to ART

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