

Hand Grip Strength and Body Composition in HIV-Infected Rural Kenyan Women

Judith Ernst¹, Grace Etyyang², Cynthia Johnson³, Winstone Nyandiko^{4,5}, Abraham Siika^{4,5}, Charlotte Neumann⁵

¹Indiana University-School of Health and Rehabilitation Sciences, ²Moi University-School of Public Health,

³ Indiana University School of Medicine, Division of Biostatistics, ⁴Moi University-School of Medicine,

⁵ USAID Academic Model Providing Access To Healthcare (AMPATH), ⁶ University of California Los Angeles, Schools of Public Health and Medicine

Objective: To compare hand grip (HG) strength with estimates of body composition (BC) in HIV-infected women.

Methods: In 256 drug naive women (WHO Stage1 or 2; CD4 cell count > 250 cells/uL), isometric strength was evaluated from HG measures using standardized technique and compared to BC estimates. The muscle areas of the mid upper-arm, mid-thigh, and mid-calf, and sum of fat skin folds (SF) were calculated with standard equations using body circumferences and SF. Predicted values of fat-free mass (FFM), percent body fat and total body water (TBW) from bioelectrical impedance analysis were calculated with standardized equations.

Results: The mean (SD) for age and CD4 were 36.7(8.1) yrs and 533(229) cells/uL respectively. Significant correlations (p<0.001) were found between HG measures (right and left hands) and estimates of muscle area on the arm, thigh and calf, FFM and TBW and (p<0.005) HG (left hand) and body mass index; correlations were not significant with fat mass estimates.

Conclusions: HG strength, when compared to estimates of BC, has a relationship to FFM, at baseline, in drug naive asymptomatic HIV-infected rural Kenyan women enrolled in an 18 month randomized nutrition intervention field trial that measures the impact of animal protein and energy on BC and HG.



Introduction

Hand grip strength (HGS) is used as a functional measure of body protein loss and is not confounded by inflammation or hydration status.

These tests are simple to administer, inexpensive, portable, and therefore may be useful in a rural field setting to capture early signs of muscle wasting in HIV-infected patients.

Measures of HGS have been shown to correlate with:

- lean muscle mass in patients in chronic renal failure¹ and chronic pulmonary disease²
- immune response, lean mass and protein status in elderly women³
- mortality in post surgery patients and the elderly⁴
- CD4 measures in HIV-infected adults⁵

Normative data exists for HGS in adults⁶

- z-scores can be calculated and changes over time can be correlated with fat free mass estimates.

Overall Objective

To determine if meat in the diets of HIV infected rural Kenyan women prevents the loss of strength and body mass in those not yet ill enough to warrant antiretroviral drugs.

Population

N = 256

drug naive HIV-infected rural Kenyan women
 CD4 > 250 cells/uL
 WHO Stage 1 and 2
 no opportunistic infections
 not pregnant

Mean (SD)

Age 36.7 (8.1) years
 CD4 535(236) cells/uL

References

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- 4) Rantanen et al, 2003, *J Am Geriatr Soc* **51**:636-41.
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Methods

Muscle strength is measured using hand grip and finger pinch hydraulic dynamometers (Jamar, JA Preston Cororation, Clifton, NJ) at baseline and repeated every 3 months and compared to body composition estimates from anthropometric and bioelectrical impedance analysis (BIA) measures taken at the same time intervals. We will confirm this association within the population of HIV-infected women.



Hand Grip



Lateral Finger Pinch



2 Point Finger Pinch



3 Point Finger Pinch

Outcome Measures*

- Estimates of muscle strength
 Hand Grip (Left and Right hands)
 Finger Pinch (Left and Right hands)
 Lateral 3 Point 2 Point
- Estimates of lean body mass
 Anthropometry: muscle areas of the:
 mid upper-arm (MAMA)
 mid-thigh (MTMA)
 mid-calf (MCMA)
 Bioelectrical Impedance Analysis (BIA)
 fat-free mass (FFM)
 total body water (TBW)
- Estimate of HIV progression
 CD4 lymphocyte count (CD4)

* Data are collected by trained enumerators

Results

Significant correlations were found between strength measures and estimates of body composition at baseline in HIV-infected rural Kenyan women.

- Hand grip measures and estimates of lean mass on the arm, thigh and calf, FFM and TBW, p<0.001; correlations were not significant with fat mass estimates
- Finger pinch and estimates of lean mass on the arm, thigh and calf, FFM and TBW, p<0.001, p<0.01, p<0.05 and CD4, p<0.05.
- Mean Hand grip and lateral finger pinch measures were closer to norms whereas 2 and 3 point finger pinch measures were much lower than norms.

Correlations at Baseline for 256 HIV-infected Kenyan Women

	Anthropometry			BIA		CD4
Body Composition	MAMA	MTMA	MCMA	FFM	TBW	CD4
Hand Grip						
Right	0.25*	0.31*	0.25*	0.38*	0.39*	-
Left	0.28*	0.33*	0.26*	0.39*	0.41*	-
Finger Pinch						
Lateral Right	0.15***	0.23*	-	0.24*	0.25*	0.13***
Lateral Left	0.17**	0.23*	-	0.24*	0.25*	0.14***
2 Point Right	-	-	-	-	-	-
2 Point Left	-	0.13***	-	0.13***	0.13***	0.13***
3 Point Right	-	0.15***	-	0.14***	0.15***	0.14***
3 Point Left	-	0.13***	-	0.14***	0.15***	0.14***

*p<0.001, **p<0.01, ***p<0.05

Values of Hand Grip and Finger Pinch Strength at Baseline for 256 HIV-infected Kenyan Women

	Hand Grip		Lateral		2 Point		3 Point	
	Right	Left	Right	Left	Right	Left	Right	Left
Mean (SD)	67.8 (12.8)	64.1 (12.1)	15.1 (4.5)	13.8 (4.4)	6.6 (4.0)	6.3 (3.6)	9.5 (5.0)	9.1 (4.7)
z score*	-0.3 (0.98)	0.6 (0.94)	-0.9 (1.8)	-0.9 (1.6)	-2.1 (1.6)	-2.2 (1.6)	-2.4 (1.5)	-2.4 (1.4)
Range	(30-100)	(34-123)	(0-26)	(0-24)	(0-16)	(0-16)	(0-21)	(0-19)
z score*	(-4.1-2.2)	(-2.1-3.1)	(-7.0-4.6)	(-6.2-3.6)	(-6.6-2.2)	(-6.3-1.7)	(-7.5-0.8)	(-6.3-0.7)
Median	68.5	63.5	15.5	14.2	7.3	7.0	10.2	9.3
z score*	-0.3	0.03	-0.8	-0.8	-2.0	-1.9	-2.2	-2.1

* Mathiowetz, 1985

Conclusions

Hand strength, as measured by hand grip and finger pinch dynamometry, when compared to estimates of body composition, shows a relationship to FFM, at baseline, in drug naive asymptomatic, HIV-infected rural Kenyan women enrolled in an 18 month randomized nutrition intervention field trial that measures the impact of animal protein and energy on body composition and hand strength.

Repeated measures, every 3 months during the intervention and 6 months post the intervention will be assessed and compared for a treatment effect.



This publication was made possible through support provided to the Global Livestock Research Support Program by the Office of Agriculture, Bureau for Economic Growth, Agriculture and Trade, United States Agency for International Development under terms of Grant No. PCE-G-00-98-00036-00. The opinions expressed herein are those of the authors and do not necessarily reflect the views of the USAID. This work was also supported, in part by 1R01HD57646-01A1 (CFDA #93.865).