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Physical Activity Intervention Effects on Waist-to-Hip Ratio in African American Men Living With HIV

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Abstract

People living with HIV on antiretroviral therapy have an increased risk of developing metabolic disturbances and central adiposity. Adequate engagement in physical activity (PA) could reduce the risk of chronic diseases associated with central adiposity. We conducted a secondary analysis of data from a randomized controlled trial of a PA intervention with 302 African American men aged 40 or older (53.9±7.2 years) living with HIV to assess whether the intervention reduced the waist-to-hip ratio (WHR). Generalized estimating equation analyses tested whether the PA intervention reduced WHR compared with the control group and whether age moderated its effect, adjusting for follow-up assessment time (3, 6, and 12 months postintervention) and baseline WHR and age. The analysis revealed that the intervention's effect on WHR was not significant ($B = -0.008$, $p = .097$). However, a significant interaction between age and the intervention ($B = 0.001$, $p = .046$) indicated that the intervention's effect in reducing WHR waned with increasing age. For instance, when dividing participants into three age subgroups, the intervention reduced WHR for men ages 40 to 50 ($B = -0.020$, $p = .013$) and ages 50 and 60 ($B = -0.007$, $p = .315$) but increased it among those older than 60 ($B = 0.013$, $p = .252$). The intervention's effects on WHR differed by participants' age, suggesting that different PA strategies may be needed based on age to improve the metabolic profile and reduce chronic disease risk in African American men living with HIV.

Keywords

male, HIV, African American, waist-to-hip ratio, adiposity, exercise

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Introduction

Antiretroviral therapy (ART) has increased life expectancy among people living with HIV (Masenga et al., 2020). ART is known to increase the risk for central and visceral adiposity (Dimala et al., 2018; Koethe et al., 2020). Central adiposity, a waist circumference ≥102 cm or waist-to-hip ratio (WHR) ≥0.90 in men is related to adverse metabolic outcomes, such as insulin resistance, hypertension, and dyslipidemia, which are known risk factors for cardiovascular diseases and cancer (Owolabi et al., 2017). Alterations in fat deposit with ART are compounded by morphological changes that occur in people living with HIV and the rising prevalence of obesity (Koethe et al., 2020; Wohl, 2004). Evidence from numerous studies suggests beneficial effects of physical activity in reducing visceral fat and the burden of chronic diseases (González et al., 2017; Kay & Fiatarone Singh, 2006).

African American men in particular experience higher rates of mortality and morbidity from chronic health conditions, including heart disease, diabetes, and HIV/AIDS (Randolph et al., 2018). African American men often fall short in meeting national recommendations for physical activity (Centers for Disease Control and Prevention, 2022). For instance, only 20.1% of African American adults compared with 25.6% of non-Hispanic Whites met the 2008 federal physical activity guidelines (National Center for Health Statistics, 2019; U.S. Department of Health & Human Services, 2008). These results underscore the need for interventions to improve physical activity among African American adults. Evidence

demonstrates a strong association of physical activity on WHR in men (Trichopoulou et al., 2001).

WHR, recommended by the World Health Organization (1999) in defining metabolic syndrome, is one of the most accurate measures of central adiposity and predictors of cardiometabolic risk (Dimala et al., 2018). Results from several studies demonstrate a predictive relationship of WHR with visceral fat and metabolic risk (Kay & Fiatarone Singh, 2006). Although evidence from cross-sectional studies (Kay & Fiatarone Singh, 2006) indicates an inverse relationship between physical activity and WHR, little is known about the influence of physical activity on central adiposity among African American men living with HIV. The aim of this study was to examine whether an intervention (Jemmott et al., 2021) to increase physical activity reduced WHR in an urban sample of African American men living with HIV.

Method

We conducted a secondary analysis of data from a randomized controlled trial of a physical activity intervention to assess whether the intervention reduced WHR. This study was reviewed and approved (protocol #813202) by the Institutional Review Board of the University of Pennsylvania. Written informed consent was required to participate. Participants were African American men aged 40 years or older living with HIV. The participants volunteered for a randomized controlled trial examining the efficacy of a health promotion intervention encouraging physical activity and healthy diet behaviors. The University of Pennsylvania's CFAR Clinical Core Adult/Adolescent Database, which contains data on people who were living with HIV and agreed to be contacted for research participation, was used for participant recruitment. Patients were also referred by providers at the University of Pennsylvania's Presbyterian HIV Clinic, the Drexel University/Partnership Clinics, and AIDS service organizations in Philadelphia, PA. In addition, participants were recruited through advertisements in a local newspaper and on social media sites, including Facebook, Twitter, and Craig's list.

Eligible participants for the study were 40 or older men, self-identified as Black or African American, and receiving ART for HIV. We verified that participants were receiving ART for HIV based on a referral of an HIV care provider or proof of a prescription for ART. We excluded people who participated in any intervention trials in the past 12 months targeting physical activity, diet, or prostate or colorectal cancer screening, or those whose blood pressure was 180/110 mm Hg or higher. We also excluded those who had a plan to relocate in the next 18 months or those who did not have a mailing address because it would be challenging for researchers to collect postintervention data.

The Physical Activity Intervention

African American men aged 40 years and older living with HIV were randomized to a one-session health awareness control condition or a health promotion intervention targeting physical activity (Jemmott et al., 2021). The three-session physical activity intervention based on social cognitive theory and the reasoned action approach encouraged participants to adhere to guidelines set forth by the U.S. Department of Health & Human Services (2008). The intervention utilized videos, physical exercise, and educational games to increase adherence to physical activity guidelines.

Measures

Trained research coordinators measured the participants' waist circumference from the front at the narrowest part of the participant's torso and the participants' hip circumference from the side around the widest part of the participant's buttocks using a cloth tape measure. The research coordinators had been trained to ensure that no compression of the skin or underclothing occurred and that the tape was strictly horizontal. WHR was calculated by dividing the waist circumference by the hip circumference.

Statistical Analysis Plan

Generalized estimating equation (GEE) analyses tested whether the physical activity intervention reduced WHR compared with the control group and whether age moderated its effect, adjusting for follow-up assessment time

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Table 1. Baseline Characteristics of Participants.

Characteristics ($N = 302$)	All participants	Control	PA intervention
Age, *M* (*SD*)	53.88 (7.24)	54.18 (6.33)	53.59 (8.05)
Less than or equal to 50, *n* (%)	99 (32.8)	44 (29.3)	55 (36.2)
Greater than 50 and less than or equal to 60, *n* (%)	158 (52.3)	86 (57.3)	72 (47.4)
Greater than 60, *n* (%)	45 (14.9)	20 (13.3)	25 (16.5)
Completed at least high school, *n* (%)	228 (75.5)	113 (75.3)	115 (75.7)
Unemployed, *n* (%)	252 (83.4)	127 (84.7)	125 (82.2)
Monthly individual income, *n* (%)			
Less than US$850	200 (67)	95 (63.3)	105 (69.1)
US$850 or more	102 (33)	55 (36.7)	47 (30.9)
Unstable housing, *n* (%)	44 (14.6)	17 (11.3)	27 (17.8)
BMI, *M* (*SD*)	28.19 (5.94)	28.71 (6.62)	27.68 (5.16)
Waist circumference, *M* (*SD*)	39.25 (5.89)	39.97 (6.30)	38.55 (5.38)
Waist-hip ratio, *M* (*SD*)	0.95 (0.07)	0.95 (0.07)	0.94 (0.07)
Met physical activity guidelines, *n* (%)	34 (11.3)	16 (10.7)	18 (11.8)

Note. PA = physical activity; BMI = body mass index.

Table 2. Waist-to-Hip Ratio by Condition and Assessment Period.

Condition	Baseline	3-month	6-month	12-month
Control	0.95 (0.07)	0.95 (0.07)	0.95 (0.07)	0.96 (0.08)
PA intervention	0.94 (0.07)	0.93 (0.06)	0.94 (0.06)	0.95 (0.07)

Note. Values are represented as *M* (*SD*). PA = physical activity.

(3, 6, and 12 months postintervention), baseline WHR, and age. Specifically, we estimated a GEE model to examine the interaction effect of the intervention and age on the outcome variable. To help interpret a significant interaction, we also ran separate GEE models highlighting the intervention's effect on the outcome for each of the three age subgroups. All analyses were conducted using SAS 9.4.

Results

The sample was 302 African American men aged 40 or older (53.9±7.2 years) living with HIV. Table 1 presents the sociodemographic characteristics of participants at baseline. The average WHR of participants was 0.95 ($SD = 0.07$). The average WHR of the participants in the control condition was 0.95 ($SD = 0.07$) and it was 0.94 ($SD = 0.07$) among participants in the intervention condition. The control and the intervention groups were also comparable in other characteristics. The proportion of participants who completed at least high school was 75.3% ($N = 113$) in the control condition and 75.7% ($N = 115$) in the intervention condition. The proportion of participants who were unemployed was 84.7% ($N = 127$) and 82.2% ($N = 125$) for the control and the intervention groups, respectively. Participants with a monthly income of less than US$850 accounted for 63.3% ($N = 95$) and 69.1% ($N = 105$) of the control group and the intervention group, respectively. Table 2 presents the mean and the standard deviation of WHR by condition and assessment period.

We first examined the effect of the physical activity intervention on WHR. The effect of the intervention on WHR was not significant. To be specific, in the GEE regression model estimating WHR, the coefficient of the intervention was negative but not statistically significant ($B = -0.008$, $z = -1.656$, $p = .097$), controlling for time and the baseline outcome as covariates.

We then examined the interaction effect between age and the physical activity intervention on WHR, as presented in Table 3. We identified a significant interaction between age and the intervention on WHR ($B = 0.001$, $z = 1.996$, $p = .046$), controlling for the intervention, age, time, and the baseline outcome. The result indicates that the intervention's effect of reducing WHR generally decreases for older participants.

To understand the interaction effect between age and the intervention on WHR, we divided participants into three different age groups and examined the effect of the intervention on WHR within each subgroup. The intervention significantly reduced WHR for the subgroup of participants with ages between 40 and 50 ($B = -0.020$, $z = -2.485$, $p = .013$). The intervention nonsignificantly reduced WHR among the subgroup of participants between 51 and 60 ($B = -0.007$, $z = -1.005$, $p = .315$)

Table 3. The GEE Model Estimating the Interaction Effect of the PA Intervention and Age on WHR, Controlling for Time, Age, and the Baseline Outcome; and the GEE Models Within Each Age Subgroup, Controlling for Time and the Baseline Outcome.

Independent variable	Estimate	*SE*	*p*
PA Intervention × Age among all participants			
PA Intervention × Age	0.001	0.001	.046
PA intervention	−0.078	0.036	.030
Age	0.000	0.001	.643
Time (6 months)	0.002	0.004	.522
Time (12 months)	0.010	0.004	.014
Baseline outcome	0.548	0.060	<.001
Intercept	0.424	0.057	<.001
Subgroup analysis among participants with ages 40–50			
PA intervention	−0.205	0.008	.013
Time (6 months)	0.000	0.006	.943
Time (12 months)	0.004	0.006	.537
Baseline outcome	0.580	0.062	<.001
Intercept	0.402	0.057	<.001
Subgroup analysis among participants with ages 51–60			
PA intervention	−0.007	0.007	.315
Time (6 months)	0.005	0.005	.372
Time (12 months)	0.010	0.006	.079
Baseline outcome	0.512	0.102	<.001
Intercept	0.461	0.095	<.001
Subgroup analysis among participants with ages 61 and older			
PA intervention	0.013	0.012	.252
Time (6 months)	−0.003	0.009	.771
Time (12 months)	0.022	0.012	.066
Baseline outcome	0.601	0.053	<.001
Intercept	0.379	0.052	<.001

Note. GEE = generalized estimating equation; PA = physical activity; WHR = waist-to-hip ratio.

and nonsignificantly increased WHR among participants older than 60 ($B = 0.013$, $z = 1.145$, $p = .252$).

Discussion

In the present study of African American men aged 40 and older living with HIV, we showed that a physical activity intervention's effects on WHR declined with increasing age. The results revealed that a one-size-fits all approach is inappropriate and interventions should be tailored based on age.

The findings from this study that the effect of the intervention on WHR declined for African American men 60 and older differ from those observed in prior research. In their randomized controlled trial of a home-based program, physical activity, and nutrition for seniors (aged 60 to 70), Burke and colleagues observed a significant decrease in WHR over a 6-month period in study participants (Burke et al., 2012). A randomized control trial examining trends of nutrition and exercise interventions to improve diabetes management and physical function in 29 disadvantaged older Hispanics with Type 2 diabetes reported improvements in WHR among the diet-only group compared with the diet + exercise group (Vieira et al., 2021). These studies highlight that the use of physical activity alone may be insufficient to reduce WHR among individuals with central adiposity.

The present study identified that the physical activity intervention reduced WHR among middle-aged men (aged 40 to 60), but increased WHR for men older than 60. Age is linked to a decline in muscle and an increase in fat, which could be a plausible explanation for increased WHR among older African American men living with HIV (Hunter et al., 2010; Kalyani et al., 2014). These findings provide preliminary evidence to support early intervention to reduce the burden of central adiposity among African American men living with HIV. Moreover, these findings highlight the need for clinical assessments of WHR among African American men living with HIV to mitigate cardiovascular risk and mortality.

To the best of our knowledge, this is the first age- and gender-specific study to examine a physical activity intervention and changes in WHR among African American men living with HIV. The randomized

controlled trial and the use of standard procedures to assess WHR are strengths of this study. However, there are some limitations that must be acknowledged. The results of this study are limited given the small sample. An additional limitation is that participants were African American men 40 and older living with HIV enrolled in a health promotion trial; therefore, results may not be generalizable beyond this population. Finally, we did not measure length of diagnosis and length of time for ART.

In conclusion, central adiposity and low engagement in physical activity pose a threat for African American men living with HIV. The findings of this study demonstrate that a physical activity intervention may be an avenue to decrease WHR and subsequent risks of cardiovascular diseases among middle-aged African American men living with HIV. The findings of this study are promising and have implications for interventions to improve the metabolic profile and reduce chronic disease risk among African American men living with HIV.

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Declaration of Conflicting Interests

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References

Burke, L., Lee, A. H., Pasalich, M., Jancey, J., Kerr, D., & Howat, P. (2012). Effects of a physical activity and nutrition program for seniors on body mass index and waist-to-hip ratio: A randomised controlled trial. *Preventive Medicine*, *54*(6), 397–401. https://doi.org/10.1016/j.ypmed.2012.03.015

Centers for Disease Control and Prevention. (2022). *Adult physical inactivity prevalence maps by race/ethnicity*. https://www.cdc.gov/physicalactivity/data/inactivity-prevalence-maps/index.html

Dimala, C. A., Ngu, R. C., Kadia, B. M., Tianyi, F. L., & Choukem, S. P. (2018). Markers of adiposity in HIV/AIDS patients: Agreement between waist circumference, waist-to-hip ratio, waist-to-height ratio and body mass index. *PLOS ONE*, *13*(3), Article e0194653. https://doi.org/10.1371/journal.pone.0194653

González, K., Fuentes, J., & Márquez, J. L. (2017). Physical inactivity, sedentary behavior and chronic diseases. *Korean Journal of Family Medicine*, *38*(3), 111–115. https://doi.org/10.4082/kjfm.2017.38.3.111

Hunter, G. R., Gower, B. A., & Kane, B. L. (2010). Age related shift in visceral fat. *International Journal of Body Composition Research*, *8*(3), 103–108.

Jemmott, J. B., III, Jemmott, L. S., Zhang, J., Icard, L. D., Kelly, T. A., Frank, I., & Bellamy, S. L. (2021). Effects of a health promotion intervention on physical activity in African American men living with HIV: Randomized controlled trial. *AIDS Patient Care and STDs*, *35*(10), 377–384. https://doi.org/10.1089/apc.2021.0039

Kalyani, R. R., Corriere, M., & Ferrucci, L. (2014). Age-related and disease-related muscle loss: The effect of diabetes, obesity, and other diseases. *The Lancet Diabetes & Endocrinology*, *2*(10), 819–829. https://doi.org/10.1016/S2213-8587(14)70034-8

Kay, S. J., & Fiatarone Singh, M. A. (2006). The influence of physical activity on abdominal fat: A systematic review of the literature. *Obesity Reviews: An Official Journal of the International Association for the Study of Obesity*, *7*(2), 183–200. https://doi.org/10.1111/j.1467-789X.2006.00250.x

Koethe, J. R., Lagathu, C., Lake, J. E., Domingo, P., Calmy, A., Falutz, J., Brown, T. T., & Capeau, J. (2020). HIV and antiretroviral therapy-related fat alterations. *Nature Reviews. Disease Primers*, *6*(1), 48. https://doi.org/10.1038/s41572-020-0181-1

Masenga, S. K., Elijovich, F., Koethe, J. R., Hamooya, B. M., Heimburger, D. C., Munsaka, S. M., Laffer, C. L., & Kirabo, A. (2020). Hypertension and metabolic syndrome in persons with HIV. *Current Hypertension Reports*, *22*(10), 78. https://doi.org/10.1007/s11906-020-01089-3

National Center for Health Statistics. (2019). https://public.tableau.com/app/profile/nhis6957/viz/FIGURE7_6/Dashboard7_6

Owolabi, E. O., Ter Goon, D., & Adeniyi, O. V. (2017). Central obesity and normal-weight central obesity among adults attending healthcare facilities in Buffalo City Metropolitan Municipality, South Africa: A cross-sectional study. *Journal of Health, Population, and Nutrition*, *36*(1), 54. https://doi.org/10.1186/s41043-017-0133-x

Randolph, S., Coakley, T., & Shears, J. (2018). Recruiting and engaging African-American men in health research. *Nurse Researcher*, *26*(1), 8–12. https://doi.org/10.7748/nr.2018.e1569

Trichopoulou, A., Gnardellis, C., Lagiou, A., Benetou, V., Naska, A., & Trichopoulos, D. (2001). Physical activity and energy intake selectively predict the waist-to-hip ratio in men but not in women. *The American Journal of Clinical Nutrition*, *74*(5), 574–578. https://doi.org/10.1093/ajcn/74.5.574

U.S. Department of Health & Human Services. (2008). *2008 physical activity guidelines for Americans*. https://health.gov/sites/default/files/2019-09/paguide.pdf

Vieira, E. R., Cavalcanti, F., Civitella, F., Hollifield, M., Caceres, S., Carreno, J., Gaillard, T., Huffman, F. G., Mora, J. C., & Queiroga, M. R. (2021). Effects of exercise and diet on body composition and physical function in older Hispanics with type 2 diabetes. *International Journal of Environmental Research and Public Health*, *18*(15), 8019. https://doi.org/10.3390/ijerph18158019

Wohl, D. A. (2004). Diagnosis and management of body morphology changes and lipid abnormalities associated with HIV Infection and its therapies. *Topics in HIV Medicine: A Publication of the International AIDS Society, USA*, *12*(3), 89–93.

World Health Organization. (1999). *Definition, diagnosis and classification of diabetes mellitus and its complications: Report of a WHO consultation. Part 1: Diagnosis and classification of diabetes mellitus*. https://www.staff.ncl.ac.uk/philip.home/who_dmg.pdf