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PHYSICAL ACTIVITY LEVELS OF HIV-INFECTED INDIVIDUALS IN RURAL AND URBAN COMMUNITIES IN FREE STATE PROVINCE, SOUTH AFRICA

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ABSTRACT

HIV infection increases fatigue and physical inactivity. This study aimed to determine levels of physical activity associated with HIV infection in individuals from rural and urban communities in the Free State Province, South Africa. Adults aged 25–64 years were eligible to participate. Ninety-seven (17.1%) of the 567 rural and 172 (40.6%) of the 424 urban participants were HIV-infected. Logistic regression with forward selection ($p<0.05$) was used to select significant independent physical activity levels (PAL) associated with HIV status. Variables with a p-value of <0.15 were considered for inclusion in the model. In urban areas, the median PAL of both males and females fell in the low-active category, while in rural areas HIV-uninfected males and females were more active than HIV-infected participants. In the rural sample, HIV infection was positively associated with being sedentary versus very active (odds ratio 3.18, CI 1.31; 7.70); low active versus very active (odds ratio 2.27, CI 1.08; 4.77); and active versus very active (odds ratio 2.44, CI 1.31; 4.55). Being physically inactive was positively associated with HIV infection in the rural sample of this study, confirming that decreased physical activity is often an outcome of HIV infection.

Keywords: HIV; Physical activity; Health benefits; Free State Province, South Africa.

INTRODUCTION

Physical activity is associated with decreased morbidity and mortality and is an essential component of healthy aging (Peltzer & Phasawana-Mafuya, 2012). Exercise is an important strategy for people living with human immunodeficiency virus (HIV) infection. However, knowledge about the effects of exercise among adults living with HIV is still limited. Earlier studies have reported that exercise in HIV-infected persons may lead to improved psychological well-being, functional aerobic capacity, quality of life, cardiovascular profile, body cell mass and strength (Smith *et al*., 2001; Hand *et al*., 2008; Mutimura *et al*., 2008; O'Brien *et al*., 2010). Exercise is also beneficial in treating psychological conditions, such as depression and anxiety that are common in HIV-infected individuals (Dudgeon *et al*., 2004). However, there are numerous barriers to physical activity (Roos *et al*., 2015), which include physical factors (such as low-energy levels), psychological factors (for example, stress levels), family responsibility (including being primary caregivers), the physical environment (such as adverse weather conditions), social environment (including domestic abuse and crime) and the workplace (such as being in a sedentary job) (Roos *et al*., 2015).

HIV-associated lipodystrophy is a term used to describe a group of body composition (lipoatrophy and lipohypertrophy) and metabolic (dyslipidemia and insulin resistance) changes that are commonly associated with the use of highly active antiretroviral therapy (HAART) (Singhania & Kotler, 2011). Lipodystrophy can increase the risk of developing cardiovascular disease and diabetes (Segatto *et al*., 2011). It has been recommended that lipohypertrophy can be managed by lifestyle modification, including increased physical activity levels (Singhania & Kotler, 2011). Insufficient studies, however, have addressed this issue (Segatto *et al*., 2011).

Information related to the physical activity levels of both HIV-infected persons that are antiretroviral (ARV)-naïve and HIV-infected individuals on ARV therapy in the Free State Province of South Africa is lacking (Hattingh *et al*., 2011). The Assuring Health for All in the Free State (AHA FS) study, aimed to determine how living in rural and urban areas influences the lifestyles of populations that predispose them to both chronic diseases (such as obesity, diabetes mellitus and cardiovascular disease), as well as undernutrition and HIV/acquired immune deficiency syndrome (AIDS). Such data have the potential to determine which factors associated with HIV/AIDS should be included in the assessment and relevant management of HIV-infected persons.

PURPOSE OF RESEARCH

The present study investigated levels of physical activity in HIV-infected and HIV-uninfected persons in rural and urban communities in the Free State Province, South Africa. Also, independent categories of physical activity that were significantly associated with HIV status were determined.

METHODOLOGY

The study was undertaken in three rural Free State Province towns, namely Trompsburg, Philippolis, and Springfontein, while the urban study was conducted in Mangaung. A cross-sectional study design was adopted.

Target population and sampling

In rural areas, all households in township areas were eligible to participate. In Mangaung, the plots in the Mangaung University Community Partnerships Programme (MUCPP) service area were counted on a municipal map and included Buffer, Freedom Square, Kagisanong, Chris Hani, Namibia, and Turflaagte. An estimate was made of additional squatter houses in open areas.

A stratified proportional cluster sample was selected in urban areas, stratified by area and formal plot/squatter households in open spaces. Using randomly selected X and Y coordinates, one hundred starting points were selected in this way. From each location, five adjacent houses were approached to participate in the study. Every adult member of the household, between the ages of 25 and 64 years, in both rural and urban communities, who signed informed consent, was eligible to participate.

Methods and techniques

A pilot study was undertaken with five persons similar to the target group in each area before the primary survey, to determine whether questions included in the questionnaire were easily understood and to establish the amount of time needed to complete the questionnaires.

The level of physical activity was determined using a combination of a 24-hour physical activity recall and an adapted Baecke questionnaire (Baecke *et al*., 1982) that was completed in an individual interview with each adult. Participants were asked to mention all the activities that they had performed during the past 24 hours. From this information the researchers calculated physical activity level (PAL) for each participant as follows: the PAL values of various activities performed throughout the day were determined by adding the PAL for each activity. Because not all activities were reported in the 24-hour recall, a short physical activity frequency per week form was used for cross-referencing. This procedure was followed for all activities and added to get a total PAL per week. The total PAL/week was then divided by seven to get the average PAL/day. All results were categorised according to the classification of Frary and Johnson (2008), adapted by the Institute of Medicine of the National Academies (2002) (IOM, 2002).

Variables and operational definitions for this study were PAL classified as sedentary (1-1.39), low active (1.4-1.59), active (1.6-1.89) and very active (1.9-2.5) (Frary & Johnson, 2008).

Validity and reliability

To ensure validity, all questions were related to the objectives of the study and questionnaires were developed based on issues discussed in the relevant literature. Replication observations in the recall of 24-hour physical activity assessment are impossible, and therefore exact reproducibility is very difficult to determine (Gibson, 2005). All questionnaires were completed by trained students under the supervision of lecturers in the department. The Baecke questionnaire was reported to be a valid tool for the evaluation of typical physical activity when applied to a population of HIV/AIDS participants (Florinda *et al*., 2006).

Data collection

Before data collection, orientation meetings for members of the community and other stakeholders were organised in each community. Stakeholders included community leaders, clinic staff, church leaders, and any members of the community who wanted to learn more about the project.

Data collection took place at the community hall in the towns of rural areas and the MUCPP nutrition centre in Mangaung. Identity documents were reviewed to ascertain the age of participants. Stations for the collection of blood and urine samples; a food station; medical examination; as well as anthropometric measurements were set up. Thereafter, the following questionnaires were completed: socio-demography (one per household); household food security (one per household); 24-hour recall of dietary intake (one for each participant); 24-hour recall of physical activity (one for each participant); and self-reported health status (one for every participant).

Blood was analysed in an accredited laboratory using standard techniques. Sixty millimetres of blood were collected from each participant. Blood samples were immediately stored in ice-filled containers and transported to the laboratory.

Ethical Clearance

The study was approved by the Health Sciences Research Ethics Committee of the University of the Free State (ETOVS 27/07), the Free State Department of Health (DoH) and local municipalities. Written informed consent in language of choice was obtained from participants.

Statistical analysis

All analyses were performed by the Department of Biostatistics, University of the Free State. Descriptive statistics, including frequencies and percentages for categorical data and means and standards deviations (SDs) for symmetrical numerical variables or medians and percentiles for unevenly distributed numerical variables, were calculated. Differences between HIV-infected and HIV-uninfected groups were assessed by p-values [t-tests (for symmetrical numerical variables), Mann-Whitney tests (for skew numerical variables), chi-squared tests (for categorical variables) or Fischer's extract test (for categorical variables with sparse data)] or 95% confidence intervals (CIs) for median, mean or percentage differences. To choose significant independent factors associated with HIV status, logistic regression with forward selection ($p<0.05$) was applied. Variables with a p-value of <0.15 were included in the model. Gender and age were entered in each model as possible factors.

RESULTS

Of the 570 rural participants, 567 had results for HIV, of which 97 (17.1%) were HIV-infected. Of the 426 urban participants, 424 had results for HIV, with 172 (40.6%) being HIV-infected. Rural HIV-infected participants were significantly younger (median age 40.5 years) than HIV-uninfected rural participants (median age 51 years) (p=0.001). A similar trend was found in the urban sample (HIV-infected respondents: median age 38 years; HIV-uninfected respondents: median age 49 years; p=0.0001).

***Table 1*. PHYSICAL ACTIVITY LEVEL OF HIV-INFECTED AND HIV-UNINFECTED PARTICIPANTS IN RURAL AND URBAN AREAS**

	HIV-infected					HIV-uninfected					p-Value
	n	**Median**	**25%**	**75%**	**Range**	**n**	**Median**	**25%**	**75%**	**Range**	
Males	N=59					N=143					
Rural	24	1.7	1.4	2.1	1.2-1.9	84	1.8	1.5	2.2	1.2-4.1	0.65
Urban	35	1.5	1.4	1.7	1.1-2.6	59	1.5	1.3	1.7	1.1-2.4	0.54
Females	N=192					N=538					
Rural	62	1.7	1.5	1.9	1.2-3.0	354	1.8	1.6	2.1	1.1-4.5	0.02*
Urban	130	1.5	1.4	1.6	0.2-2.2	184	1.5	1.5	1.7	0.1-2.0	0.18

A total number of 108 male and 416 rural female participants and 94 male and 314 urban female participants reported on PAL. Median PAL for all the participants is summarised in Table 1. The median PAL of HIV-infected rural males was lower at 1.7 (active) compared to HIV-uninfected rural males at 1.8 (active). In urban areas, the median PAL of HIV-infected males was the same as that of HIV-uninfected males (median 1.5, low active). Similar to the observation in the male participants, the median PAL of HIV-infected females in rural areas was significantly lower at 1.7 (active), compared to 1.8 (active) in HIV-uninfected females (p=0.02). In urban areas, the median PAL of HIV-infected females was the same as that of HIV-uninfected females (median 1.5, low active).

The reported health results of urban participants on antiretroviral therapy (ART) and those not on ART were also compared. Twenty-five percent (43 participants) of the HIV-infected urban respondents were using ART compared to only 4.1% (4 participants) in rural areas. Due to this low number, HIV-infected rural participants on ART were not included in the comparison of patients using ART and those not using ART. A total number of 35 males and 130 females HIV-infected urban respondents on ART (96.5%) reported on PAL. The median PAL of HIV-infected males on ART was slightly higher at 1.6 (active) than HIV-infected males not on ART (median 1.5, low active), although the difference was not statistically significant (p=0.18). The median PAL of HIV-infected urban females on ART was also slightly higher at 1.6 (active) than HIV-infected urban females not on ART (median 1.5, low active).

Table 2. **CATEGORIES OF PHYSICAL ACTIVITY LEVEL FOR HIV-INFECTED AND HIV-UNINFECTED PARTICIPANTS IN RURAL AND URBAN AREAS**

Variable	**Rural**					**Urban**				
	HIV+		**HIV–**			**HIV+**		**HIV–**		
PAL categories ***MALES*** RHP[c] 24, RHN[d] 84; UHP[e] 35, UHN[f] 59	n	%	n	%	p-Value[a]	n	%	n	%	p-Value[b]
Sedentary (1.0-1.39)	3	12.5	15	17.9	0.75	11	31.4	22	37.3	0.56
Low active (1.4-1.59)	7	29.2	14	16.7	0.24	11	31.4	18	30.5	0.92
Active (1.6-1.89)	7	29.2	19	22.6	0.50	9	25.7	12	20.3	0.54
Very active (1.9-2.5)	7	29.2	36	42.9	0.22	4	11.4	7	11.9	1.00
PAL categories ***FEMALES*** RHP 62, RHN 354; UHP 130, UHN 184	n	%	n	%	p-Value[a]	n	%	n	%	p-Value[b]
Sedentary (1.0-1.39)	9	14.5	18	5.1	0.01*	27	20.8	28	15.2	0.20
Low active (1.4-1.59)	11	17.7	61	17.2	0.92	64	49.2	89	48.4	0.88
Active (1.6-1.89)	28	45.2	126	35.6	0.15	34	26.2	62	33.7	0.15
Very active (1.9-2.5)	14	22.6	149	42.1	0.003*	5	3.9	5	2.7	0.74

[a]p-value for difference between HIV-positive and HIV-negative rural participants using chi-squared or Fisher's exact test, as appropriate
[b]p-value for difference between HIV-positive and HIV-negative urban participants using chi-squared or Fisher's exact test, as appropriate
[c]RHP=Rural, HIV-Positive; [d]RHN=Rural, HIV-Negative; [e]UHP=Urban, HIV-Positive; [f]UHN=Urban, HIV-Negative.
*Statistically significant difference

As shown in Table 2, most urban participants (both HIV-infected and -uninfected) were either sedentary or low active. Significantly more HIV-infected rural females were sedentary (14.5%) compared to HIV-uninfected rural females (5.1%) (p=0.01), while significantly more HIV-uninfected rural females were very active (42.1%) compared to 22.6% of HIV-infected females (p=0.003). A higher percentage of HIV-uninfected males living in rural areas were very active (42.9%) than HIV-infected males living in rural areas (29.2%), although the difference was not statistically significant.

Physical activity factors associated with HIV status in logistic regression model

In addition to descriptive comparisons, logistic regression was used to identify physical activity categories (sedentary, low active, active, very active) significantly associated with HIV status in the rural sample. The variables age and gender were also selected in the model. When considering these selected significant physical activity variables together for inclusion in the model, age and physical activity were selected as significant with odds ratios as indicated in Table 3.

***Table 3*. PHYSICAL ACTIVITY CATEGORIES ASSOCIATED WITH HIV STATUS (RURAL PARTICIPANTS)**

Variables	**Odds ratio (95% CI)**	**p-Value**
Age	0.93 (0.90; 0.95)	<0.0001
Physical activity		
sedentary vs. very active	3.18 (1.31; 7.70)	0.0100
low active vs. very active	2.27 (1.08; 4.77)	
active vs. very active	2.44 (1.31; 4.55)	

Physical activity factors associated with HIV status in rural participants

In this rural sample, for every one-year increase in age, the odds of being HIV-infected decreased by 7%. As far as physical activity in this sample was concerned, HIV infection was positively associated with a person being sedentary versus very active (odds ratio 3.18), low active versus very active (odds ratio 2.27) and active versus very active (odds ratio 2.44).

DISCUSSION

A global health survey conducted by the World Health Organisation (WHO) investigated the physical activity levels of adult South Africans. They found that less than one-third of South Africans met the American College of Sport Medicine and Centres for Disease Control and Prevention (CDC) recommendations for health-enhancing physical activity (WHO, 2009). In the general population, 46% of all South African adults were reported to be inactive [<600 metabolic equivalent value minutes per week (MET min/wk)] (WHO, 2009).

In 2016, national data on physical activity indicated that 53.5% of South African adults in the Free State Province have an inactive lifestyle (<600 MET min/wk) (NDOH, 2017). The South African National Health and Nutrition Examination Survey (SANHANES-1) is a national population-based cross-sectional study with a probability sample of 3840 South

Africans aged 50 years and older. This study reported high rates of physical inactivity among adults ≥50 years of age in South Africa, putting them at risk of morbidity and mortality (Peltzer & Phaswana-Mafuya, 2012).

In the current study, a higher percentage of rural participants tended to be active than those living in urban areas. In rural areas, daily functions, such as gathering and chopping wood, tending to cattle, fetching water and planting vegetables, are more common than in the urban setting (Caballero, 2006). Hattingh *et al.* (2011) assessed the physical activity of HIV-infected and HIV-uninfected females in Mangaung in the Free State Province. They identified low levels of physical activity and high rates of overweight and obesity in most of the females that could be attributed to low participation in physical activity and regular television viewing.

The prevalence of passive activities in urban environments, such as watching television, may lead to lower energy expenditure (McVeigh *et al.*, 2004). Popular modes of public transport, such as buses and taxis, are easily accessible in this community and possibly contribute to the habit of walking less (Hattingh *et al.*, 2011). Most urban HIV-infected and HIV-uninfected participants in our study were less active than the rural participants, which made it difficult to determine differences in physical activity in the urban sample. Lower physical activity levels in the urban area might indicate a transition in lifestyle patterns, including dietary and physical activity changes.

Results from the logistic regression confirmed that HIV infection was positively associated with lower levels of physical activity, which has been reported previously (Hsu *et al.*, 2005). This concurs with Olsen *et al.* (2015) who described levels of habitual physical activity in HIV patients initiated on ART in Ethiopia. The study showed that advanced HIV and malnutrition were associated with considerably lower levels of physical activity and capacity in patients at the initiation of ART (Gomes-Neto *et al*., 2013).

The advantages of arranged exercise programmes on body composition and well-being have been documented. However, patients with severe HIV/AIDS-associated wasting often present with fatigue and struggle to maintain high levels of physical activity (Hsu *et al*., 2005). Gomes-Neto *et al.* (2013) determined the effects of different types of exercise on physiological and functional measurements in HIV-infected patients using a systematic strategy for searching randomised controlled trials. They found that resistance exercise training improved outcomes related to body composition and muscle strength, with little impact on quality of life. Aerobic exercise improved body composition and aerobic capacity. Simultaneous training produced significant improvements in all outcomes evaluated, although moderate intensity and a long duration were necessary. It was concluded that physical exercise is a safe and beneficial intervention in patients with HIV (Gomes-Neto *et al*., 2013).

A quality-of-life study by Singhania and Kotler (2011) in patients with HIV lipodystrophy showed that patients on ART can enjoy a good quality of life, including good physical functioning. A study that evaluated the effects of strength and endurance training on insulin sensitivity and fat distribution in HIV-infected patients with lipodystrophy found that both endurance and strength training increased insulin sensitivity, whereas only strength training reduced trunk fat mass. It was suggested that an appropriate exercise programme should include strength training, as well as endurance training to reduce the risk of cardiovascular disease in HIV-infected patients with lipodystrophy (Lindegaard *et al*., 2008).

Despite the advantages of physical activity in both ARV-naïve HIV-infected patients and those on ART, performing the tasks of day-to-day living could be challenging for HIV-infected people. Therefore, caregivers need to provide assistance for people living with HIV in activities of daily life, such as maintaining hygiene, eating and dressing (Majumdar & Mazaleni, 2010), all of which require less effort to perform if a person is physically fit. Relevant interventions aimed at encouraging physical activity in HIV-infected persons from resource-poor areas are required urgently.

CONCLUSION

Lower levels of physical activity were positively associated with HIV infection. In an effort to improve overall wellbeing and quality of life, interventions to improve physical activity in HIV-infected persons should consider sustainable ways of including both aerobic and resistance exercise in daily activities.

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