South African Family Practice 2014; 56(3):196–200
http://dx.doi.org/10.1080/20786204.2014.936663

S Afr Fam Pract
ISSN 2078-6190 EISSN 2078-6204

RESEARCH

Assessment of the physical activity, body mass index and energy intake of HIV-uninfected and HIV-infected women in Mangaung, Free State province

Z Hattingh,[a]* M Le Roux,[b] M Nel[c] and C Walsh[d]

[a] *Hotel School, Central University of Technology, Free State, Bloemfontein*
[b] *School of Design Technology and Visual Art, Central University of Technology, Bloemfontein*
[c] *Department of Biostatistics, Faculty of Health Sciences, University of the Free State, Bloemfontein*
[d] *Department of Nutrition and Dietetics, Faculty of Health Sciences, University of the Free State, Bloemfontein*
**Corresponding author, e-mail: hattingz@cut.ac.za*

Background: Declining levels of physical activity at workplaces, during leisure time and when travelling, accompanied by increasing exposure to the mass media, are major determinants of the global obesity epidemic. This study aimed to assess physical activity, the body mass index (BMI) and energy intake of human immunodeficiency virus (HIV)-uninfected and HIV-infected black women in Mangaung.
Method: A random sample of 500 black women was selected in Mangaung. Physical activity levels, dietary intake and BMI were determined in younger and older women, aged 25–34 and 35–44 years, respectively.
Results: Of the 488 women who qualified for participation, 61% of the younger women and 38% of the older women were HIV-infected. Low physical activity levels were reported in most women, and more than 50% were overweight or obese. The BMI of HIV-infected younger women with low physical activity levels (24.9 kg/m^2) was significantly lower than that of the HIV-uninfected younger women (27.2 kg/m^2) (*p*-value 0.02). The energy intake of older HIV-infected women with low physical activity levels was significantly lower (10 090 kJ) than that of the older HIV-infected women in the normal to high physical activity category (14 519 kJ) (*p*-value 0.03).
Conclusion: A more active lifestyle and energy-reduced diet that focuses on food quality could partially address BMI parameters in HIV-uninfected women. Safeguarding a lean BMI in HIV-infected women, by increasing physical activity levels while maintaining current energy intake, with an emphasis on healthy eating practices, could support quality of life.

Keywords: black women, BMI, dietary intake, HIV, physical activity, South Africa

Introduction

The financial resources of the South African health sector are being crippled by human immunodeficiency virus (HIV),[1] which is particularly prevalent in young women,[2] as well as by chronic medical conditions, including obesity and other lifestyle-related illnesses.[3-5] In 2010, the HIV prevalence rate in women attending antenatal clinics in the Free State province was established to be an alarming 30.6%.[2] Furthermore, the country is experiencing a nutrition transition[6,7] that features diet-related conversions and a reduction in physical activity patterns[8] that are exceptionally evident in black South African women who are in the midst of an urbanisation phase.[3,9,10] A previous countrywide survey, in which HIV status was unknown, revealed that 32% of black women were obese and 26.7% were overweight,[11] while 53.8% were overweight or obese in a study in North West province (that borders the Free State).[4] However, participating in some form of physical activity would have a favourable effect on cardiovascular health, while combating outcomes such as type 2 diabetes,[12] respiratory infections[13,14] and overweight or obesity.[13]

Physical activity in HIV-infected individuals may support appetite and energy levels while curbing disease-related effects, such as anxiety and depression, thereby enhancing life quality.[15-17] Together with optimal nutrition, physical activity can be indispensable in maintaining a healthy body weight and lean body mass.[18]

There are a lack of data on the physical activity levels of HIV-uninfected and antiretroviral (ARV)-naïve individuals infected with HIV in the Free State province. The South African government's roll-out programme, according to which individuals with low CD4 cells counts qualify for free ARV medication,[19] was implemented after this study was initiated in 2000.

This study reflects the physical activity levels, body mass index (BMI) and energy intake of HIV-uninfected and HIV-infected South African women who are not using ARV medication, aged 25–44 years, with low socio-economic status, living in Mangaung, Free State province.

Method

A representative sample of 500 women residing in two informal settlements (Joe Slovo and Namibia) and two formal settlements (Pahameng and Botshabela) in Mangaung was selected to participate. Plots in the designated areas were counted and numbered. There were 1 359 plots in Joe Slovo, 2 995 in Namibia, 1 711 in Pahameng and 2 308 in Botshabela. A proportionate number of respondents (180 from Namibia, 100 from Pahameng, 80 from Joe Slovo and 140 from Botshabela) was selected randomly from these plots. The four settlements were considered to be representative of Mangaung. Non-pregnant, premenopausal black women meeting the age requirement were targeted to participate by two trained community health workers, covered in a separate publication of

this study.[20] The study was approved by the Ethics Committee of the Faculty of Health Sciences, University of the Free State (ETOVS No 02/00).

Fasting blood samples were collected as part of the larger study to establish a comprehensive biochemical profile and the HIV status of the women. Respondents were informed that their HIV status would be determined, and they were requested to give written informed consent after pre-test counselling was performed. Very few women were aware of their HIV status and were given the option of receiving the results. Those who chose to do so were referred to a medical practitioner for post-test counselling and follow-up.

A questionnaire, designed by Baecke, Burema and Frijters,[21] and adapted by Kruger[22] and adjusted for the current study, was administered during a personal interview with each participant to measure physical activity levels. The questionnaire was administered in English and the researchers were assisted by Sotho and Xhosa interpreters. Time was classified in the study by Kruger[22] as "never", "seldom", "sometimes" and "always". The amount of time for each activity in that study was defined as "never" when a person spent 0% of her time at work or at home on that activity. "Seldom" was defined as less than 10% of the time, and 10–50% as "sometimes". More than 50%, but less than 85%, was defined as "often", and more than 85% as "always". In the current study, respondents were asked to specify the amount of time in minutes spent on an activity. Questions relating to activities at home and work were included in the questionnaire. Work activity at home was considered to be "work" if a person did not work away from home. If a person worked away from home, "work" was calculated as work activities at work, plus those performed at home.

Respondents were categorised as "inactive", "moderately active" and "highly active". Ten per cent of participants were re-interviewed two weeks after the initial survey to confirm the reliability of responses obtained in the first interview.

The physical activity index (PAI) was categorised by the biostatistician as follows: PAI = work index + commuting index + stair index + sport index + leisure index.[21,22]

Anthropometric status and dietary intake were determined using standard methods, as reported elsewhere.[23,24]

Owing to the small number of respondents with normal and high levels of physical activity, these two categories were combined to facilitate statistical data analysis. When the PAI was lower than four, women were categorised as "low", while those with a PAI of four or higher were categorised as having "moderate to high" activity.

Statistical analysis

Data were processed using the SAS® software programme.[25] Datasets were categorised into two age groups (25–34 and 35–44 years) and two HIV status groups (HIV-uninfected and HIV-infected). Continuous variables were described by medians and percentiles for each group. Categorical variables were described using frequencies and percentages.

The physical activity question items were compared by means of the non-parametric Kruskal-Wallis test for each combination of age, HIV and physical activity group.

The responses obtained in the main survey and the reliability survey were compared by means of 2 x 2 tables for each question. If the percentage giving a conflicting answer was more than 20%, the variables were considered to be unreliable and were ignored in further computations. The difference between the two surveys was calculated and the number of non-zero differences reported for continuous variables.

Results

Of the 500 women recruited for the study, 488 were eligible to participate. Four women were pregnant following medical examinations and excluded from the study. Eight women did not meet the age requirement. Of the 488 women, 273 (55.9%) were 25–34 years of age, while 215 (44.1%) were 35–44 years of age. Sixty one per cent and 38% of the younger and older women, respectively, were HIV-infected. Of the total sample of 488, 239 women were not infected with HIV. Of these, 106 were 25–34 years old and 133 were 35–44 years old. Two hundred and forty-nine women were HIV-infected. Of these, 167 were 25–34 years old and 82 were 35–44 years. Table 1a shows the level of physical activity, energy intake and BMI of HIV-infected and HIV-uninfected women in the two age groups, while Table Ib indicates the significance of differences between the groups. Women were divided into eight groups, according to age, level of physical activity and HIV status. Groups 1–4 represented women with low levels of physical activity, while groups 5–8 represented women with normal to high levels of physical activity. Within the physical activity groups, women were further categorised according to age and HIV status.

Low levels of physical activity were reported for more than 90% of the women. The median energy intake of all of the women ranged between 10 090 kJ and 14 519 kJ. The energy intake of the women in group 4 (35–44 years old, HIV-infected, low physical activity) was significantly lower than that of the women in group 8 (35–44 years, HIV-infected, normal to high physical activity) (p-value 0.03). Since the women in these groups were both older and HIV-infected, the only difference was their level of physical activity. Therefore, the energy intake of the more physically active women was higher than that of the physically inactive women. Among the women with low levels of physical activity, younger HIV-infected women (group 2) had a significantly higher energy intake than older HIV-infected women (group 4) (p-value 0.01).

The median BMI of the younger HIV-uninfected women in group 1 (low physical activity) was 27.2 kg/m^2. By contrast, the BMI of the same group with HIV (group 2) was 24.9 kg/m^2. This difference was significant (p-value 0.001), indicating that the presence of HIV infection had a significant effect on BMI. Similarly, the BMI of HIV-infected younger women in group 6 was significantly lower than that of the older uninfected women in group 7 (p-value 0.02).

In women with low levels of physical activity, significant differences in BMI also occurred between groups 1 (young HIV-uninfected) and 3 (older, HIV-uninfected; p-value 0.02). Women who were HIV-infected and who fell into the normal to high physical activity group (group 6), also had a significantly lower BMI (22.1 kg/m^2) than women who were HIV-uninfected with a low level of physical activity at 27.2 kg/m^2 (group 1) (p-value 0.004).

Table 2 summarises the respondents' weight categories according to age, HIV status and level of physical activity. In the low physical activity groups (1–4), between 49% (group 2) and 62.5% (group 1) of women had a BMI indicative of overweight or obesity, regardless of age and HIV status. On the other hand, in the normal to high physical activity groups (5–8), a BMI

Table 1a: Level of physical activity, body mass index and energy intake of HIV-infected and HIV-uninfected women aged 25–44 years

Group	Energy intake (kJ)		Body mass index (kg/m²)	
	Median	Interquartile range	Median	Interquartile range
Inactive				
Group 1 (*n* = 88) 25–34 years, HIV-uninfected	10 349	7 566.02–15 687.7	27.2*	23.3–31.5
Group 2 (*n* = 152) 25–34 years, HIV-infected	12 072*	8 521.3–15 714.3	24.9*	21.9–28.2
Group 3 (*n* = 128) 35–44 years, HIV-uninfected	10 847	8 056.5–14 445.7	25.0*	22.1–29.3
Group 4 (*n* = 76) 35–44 years, HIV-infected	10 090*	7 401.8–13 106.1	25.6	22.1–30.4
Moderate to high physical activity				
Group 5 (*n* = 18) 25–34 years, HIV-uninfected	10 927	8 489.3–13 915.4	27.8	23.4–31.3
Group 6 (*n* = 15) 25–34 years, HIV-infected	11 074	10 626.9–18 903.5	22.1*	21.6–25.4
Group 7 (*n* = 5) 35–44 years, HIV-uninfected	11 771	11 546.2–15 100.8	27.0*	24.4–30.6
Group 8 (*n* = 6) 35–44 years, HIV-infected	14 519*	12 285.2–16 478.9	22.4	19.1–24.6

HIV: human immunodeficiency virus;
*statistically significant

exceeding 25 kg/m² ranged from 16.7% in group 8 participants, to 61.1% in group 5 participants.

Discussion

HIV prevalence, physical inactivity, overweight and obesity were high in this community. It was reported in an earlier South African study that the black population was the most active, while the Indian and white populations were the least.[7] Although the present study only investigated the physical activity patterns of black women in Mangaung, rapid urbanisation in this community may merit an advanced debate on this issue. Popkin and Gordon-Larsen[26] asserted that major determinants in the worldwide obesity epidemic include technological advances in the workplace, resulting in less physical activity; declining physical activity during leisure time; sedentary behaviour associated with modes of transportation; and increasing exposure to the mass media. Their argument appears to be valid in view of our findings. The low levels of physical activity and high rates of overweight and obesity identified in most of the women in our study possibly relate to low participation in physical activities and regular television viewing. As reported in a previous publication,[20] almost 90% of the women included in this study had access to television and/or a radio,[20] confirming the significant negative impact of the mass media on their physical activity patterns. 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. The health consequences of a lifestyle lacking in physical activities, including cardiovascular-related risk factors and obesity in black women, have been confirmed by national studies.[4-5]

A lower BMI was reported in most of the HIV-infected women in this study than in their HIV-uninfected counterparts, and the difference was statistically significant in the younger women who fell in the low physical activity category, as well as in the younger HIV-infected and older HIV-uninfected women who fell in the normal to high physical activity category. This indicates the effect of HIV infection on their anthropometric indices, even

Table 1b: Comparisons between groups for energy intake and body mass index

Comparisons	*p*-value	*p*-value
	Energy intake (kJ)	Body mass index
1-2	0.11	0.001*
1-3	0.86	0.02*
1-4	0.42	0.07
1-5	0.92	0.79
1-6	0.13	0.004*
1-7	0.35	0.77
1-8	0.12	0.08
2-3	0.09	0.44
2-4	0.01*	0.36
2-5	0.28	0.14
2-6	0.59	0.13
2-7	0.76	0.17
2-8	0.23	0.25
3-4	0.27	0.79
3-5	0.80	0.32
3-6	0.17	0.08
3-7	0.31	0.28
3-8	0.09	0.19
4-5	0.58	0.41
4-6	0.05	0.09
4-7	0.16	0.39
4-8	0.03*	0.23
5-6	0.22	0.05
5-7	0.33	0.77
5-8	0.09	0.16
6-7	0.89	0.02*
6-8	0.59	0.59
7-8	0.36	0.14

*statistically significant Kruskal–Wallis test

Table 2: Weight categories of HIV-uninfected and HIV-infected women, aged 25–44 years, with regard to levels of physical activity

Group	Body mass index categories (kg/m^2)					
	< 18.5 (underweight)		18.5–24.9 (normal weight)		≥ 25 (overweight and obese)	
	n	%	*n*	%	*n*	%
Low physical activity						
Group 1 (*n* = 88) 25–34 years, HIV-uninfected	2	2.3	31	35.2	55	62.5
Group 2 (*n* = 152) 25–34 years, HIV-infected	5	3.3	72	47.7	74	49
Group 3 (*n* = 128) 35–44 years; HIV-uninfected	4	3.1	60	46.9	64	50
Group 4 (*n* = 76) 35–44 years; HIV-infected	5	6.6	28	36.8	43	56.6
Normal to high physical activity						
Group 5 (*n* = 18) 25–34 years, HIV-uninfected	0	0	7	38.9	11	61.1
Group 6 (*n* = 15) 25–34 years, HIV-infected	0	0	11	73.3	4	26.7
Group 7 (*n* = 5) 35–44 years, HIV-uninfected	0	0	2	40	3	60
Group 8 (*n* = 6) 35–44 years, HIV-infected	0	0	5	83.3	1	16.7

in the early stage of HIV infection.[27] However, the results of this study indicate that HIV-infected women tend to have a higher energy intake than their HIV-uninfected counterparts, possibly to compensate for their weight loss.

HIV-infected individuals may encounter an array of co-morbidities resulting from disease progression, including a lack of physical activity and malnutrition, causing loss of muscle mass, fatigue and a reduction in strength, functional capacity and quality of life.[28] Moderate physical activity is considered to be safe in stable HIV-infected persons, and may offer substantial physiological and psychological benefits.[29] Within the context of the present study, physical activity revolving around social and typical household activities, may have played a significant role in maintaining the general well-being[15] of the HIV-infected women. It has been shown that an HIV diagnosis can encourage individuals to improve their physical activity habits and to revert to a healthier diet.[30]

Although the overall effect of physical activity on HIV-infected individuals has been confirmed, most studies have not demonstrated an effect on viral load or immunological indices.[28] Nonetheless, the safety of physical participation and its positive contribution to the psychological wellness of the HIV population has been established.[31] Although in the study by Dolan and co-workers[32] there were no significant differences in blood glucose levels, CD4+ cell count or viral load the impact of a supervised home-based exercise program on the physical strength, cardio-respiratory health and endurance levels of a small group of HIV-infected women has been documented in that study.[32]

Conclusion and recommendations

The promotion of a more active lifestyle and a diet that is lower in energy should be endorsed in HIV-uninfected women. In order to motivate these women, a sustainable, comprehensive and concerted approach is recommended, and one that supports the South African-based dietary guideline, "Be active". However, possible barriers to the adoption of this guideline need to be identified and addressed at community level.[33]

Participation in physical activities to preserve lean body mass,[34] as well as the safety, health and social rewards of such activities, in conjunction with healthy eating practices, need to be encouraged in HIV-infected women.

Acknowledgements — This study was financially supported by the South African National Research Foundation. The authors acknowledge the women who participated in the study, the community health workers who contacted the sample, the research team who collected the data, and Dr Daleen Struwig, medical writer, Faculty of Health Sciences, University of the Free State, for the technical and editorial preparation of the manuscript.

References

1. Joint United Nations Programme on HIV/AIDS. UNAIDS World AIDS day report. UNAIDS [homepage on the Internet. 2011. c2012. Available from: http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2011/jc2216_worldaidsday_report_2011_en.pdf
2. Department of Health, South Africa. The 2010 National Antenatal Sentinel HIV and Syphilis Prevalence Survey in South Africa. Pretoria: Department of Health, 2011: 1–71.
3. Kruger HS, Venter CS, Vorster HH. Obesity in African women in the North West province, South Africa is associated with an increased risk of non-communicable diseases: the THUSA study. Br J Nutr. 2001;86(6):733–740.
4. Kruger HS, Venter CS, Vorster HH, Margetts BM. Physical inactivity is the major determinant of obesity in black women in the North West Province, South Africa: the THUSA study. Nutrition. 2002;18(5):422–427.
5. Kruger HS, Venter CS, Vorster HH. Physical inactivity as a risk factor for cardiovascular disease in communities undergoing rural to urban transition: the THUSA study. Cardiovasc J S Afr. 2003;14(1):16–23.
6. Vorster HH, Margetts BM, Venter CS, Wissing MP. Integrated nutrition science: from theory to practice in South Africa. Public Health Nutr. 2005;8(6A):760–765.
7. Steyn NP, Bradshaw D, Norman R, et al. Dietary changes and the health transition in South Africa: implications for health policy. 84th ed. The double burden of malnutrition. Case studies from six developing countries. Rome: Food and Agriculture Organization of the United Nations, 2006; p. 295–303.

8. Popkin M. Global nutrition dynamics: the world is shifting rapidly toward a diet linked with noncommunicable diseases. Am J Clin Nutr. 2006;84(2):289–298.
9. Temple NJ, Steyn K, Hoffman M, et al. The epidemic of obesity in South Africa: a study in a disadvantaged community. Ethn Disease. 2001;11(3):431–437.
10. Malhotra R, Hoyo C, Ostbye T, et al. Determinants of obesity in an urban township of South Africa. S Afr J Clin Nutr. 2008;21(4):315–320.
11. Puoane T, Steyn K, Bradshaw D, et al. Obesity in South Africa: the South African demographic and health survey. Obes Res. 2002;10(10):1038–1048.
12. Smolin LA, Grosvenor MB. Nutrition science and applications. 4th ed. New York: John Wiley, 2003; p. 361–393.
13. Wardlaw GM, Hampl JS, DiSilvestro RA. Perspectives in nutrition. 6th ed. New York: McGraw-Hill, 2004; p. 503–538.
14. Whitney E, Rolfes SR. Understanding nutrition. Belmont: Wadsworth, 2008; p. 456–484.
15. United States Agency for International Development. HIV/AIDS: A guide for nutrition, care and support. Washington: Academy for Educational Development, 2001; p. 7–55.
16. Stringer WW. HIV and aerobic exercise: current recommendations. Sports Med. 1999;28(6):389–395.
17. Yarasheski KE, Roubenoff R. Exercise treatment for HIV-associated metabolic and anthropomorphic complications. Exerc Sport Sci Rev. 2001;29(4):170–174.
18. Dong KR, Imai CM. Medical nutrition therapy for HIV and AIDS. In: Mahan LK, Escott-Stump S, Raymond JL, editors. Krause's food and nutrition care process. 13th ed. Missouri: Saunders, 2012; p. 864–883.
19. Department of Health, South Africa. Operational plan for comprehensive HIV and AIDS care, management and treatment for South Africa [homepage on the Internet]. c2010. Available from: http://www.gov.za/documents/download.php?f=164714
20. Hattingh Z, Walsh C, Joubert G. Socio-demographic risk factors for HIV infection in women living in Mangaung, Free State. S Afr J Clin Nutr. 2009;22(4):203–207.
21. Baecke JA, Burema J, Frijters ER. A short questionnaire for the measurement of habitual physical activity in epidemiological studies. Am J Clin Nutr. 1982;36(5):936–942.
22. Kruger HS. The puzzle of obesity in African women: contributing factors and associated risk factors. [unpublished PhD thesis]. Potchefstroom: PU for CHE; 1999.
23. Hattingh Z, Walsh CM, Veldman FJ, Bester CJ. Macronutrient intake of HIV-seropositive women in Mangaung, South Africa. Nutrition Research. 2006;26:53–58.
24. Hattingh Z, Walsh CM, Bester CJ. Anthropometric profile of HIV-uninfected and HIV-infected women (25-44 years) in Mangaung, Free State. S Afr Fam Pract. 2011;53(5):474–480.
25. SAS Institute Inc. STAT® users' guide. Version 9.1. Cary: SAS Institute; 2003.
26. Popkin BM, Gordon-Larsen P. The nutrition transition: worldwide obesity dynamics and their determinants. Int J Obes Relat Metab Disord. 2004;28 Suppl 3:S2–S9.
27. Hattingh Z, Walsh C, Veldman FJ, Bester CJ. The metabolic profiles of HIV-infected and non-infected women in Mangaung, South Africa. S Afr J Clin Nutr. 2009;22(1):23–28.
28. Hand GA, Lyerly GW, Jaggers JR, Dudgeon WD. Impact of aerobic and resistance exercise on the health of HIV-infected persons. Am J Lifestyle Med. 2009;3(6):489–499.
29. Baigis J, Korniewics DM, Chase G, et al. Effectiveness of a home-based exercise intervention for HIV-infected adults: a randomized trial. J Assoc Nurses AIDS Care. 2002;13(2):33–45.
30. Collins R, Kanouse DE, Gifford AL, et al. Changes in health-promoting behavior following diagnosis with HIV: prevalence and correlates in a national probability sample. Health Psychol. 2001;20(5):351–360.
31. O'Brien K, Nixon S, Tynan AM, Glazier RH. Effectiveness of aerobic exercise in adults living with HIV: a systematic review. Med Sci Sports Exerc. 2004;36(10):1659–1666.
32. Dolan SE, Frontera W, Librizzi J, et al. Effects of a supervised home-based aerobic and progressive resistance training regimen in women infected with human immunodeficiency virus. Arch Intern Med. 2006;166(11):1225–1231.
33. Lambert EV, Bohlmann I, Kolbe-Alexander T. "Be active": physical activity for health in South Africa. S Afr J Clin Nutr. 2001;14(3 Suppl):S12–S16.
34. Smit E. Balancing the health benefits and the risk of obesity among HIV-infected youth. J Am Diet Assoc. 2004;104(10):1549–1553.

Received: 09-04-2013 Accepted: 01-07-2013