Anthropometric profile of HIV-uninfected and HIV-infected women aged 25–44 years in Mangaung, Free State

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Abstract

Background: Obesity and human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) affect significant numbers of black women in South Africa.

Method: Using township maps, a random sample of 500 black women residing in Mangaung in the Free State was selected to participate in this study in the year 2000. The women were divided into two age groups, namely 25–34 years (n = 273) and 35–44 years (n = 215). Anthropometric measurements, including height, weight [to calculate the body mass index (BMI)] and waist circumference (WC) were taken. Fat percentage was measured with bioelectrical impedance. HIV status was determined using a microparticle enzyme immunoassay method. Socio-demographic status, health status, dietary intake, level of physical activity, body perception and attitude toward weight control, as well as prevalence and risk of lifestyle diseases were determined as part of the larger study.

Results: Sixty-one per cent of younger women (25–34 years) and 38% of older women (35–44 years) were infected with HIV. In younger HIV-infected women, median BMI, WC and fat percentage were significantly lower than in HIV-uninfected women.

Conclusions: HIV infection rates were found to be higher among younger than older women. The prevalence of obesity was high overall. Median BMI values ranged between 24.4 kg/m^2 and 27.6 kg/m^2. A large percentage of all women fell in the unhealthy fat percentage category (excessive body fat), ranging between 65.9% of HIV-infected young women and 79.3% of older HIV-infected women. HIV, even in the asymptomatic stage, influences anthropometric indicators.

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Introduction

Obesity and human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), both recognised worldwide as significant public health concerns,[1] place a heavy financial burden on South African health services and remain major challenges to professional heath promoters in this country. Similar to many developing countries, South Africa is experiencing a nutrition transition,[2,3] associated with simultaneous changes in dietary composition and physical activity patterns that are reflected in anthropometric changes.[4] Universal trends associated with diets higher in energy, animal products and edible oils and with lower energy expenditure at home and at work, during leisure times and transportation,[5] have been noted in particular among black South Africans,[3,6] who are becoming increasingly urbanised.[7] Consequently, this population has progressively become vulnerable to the development of noncommunicable diseases[3,8-10] such as obesity and related illnesses,[11-13] There is convincing evidence of relatively high prevalence rates of excess weight and obesity, particularly among urban[7] black South African women.[11,14-16] Results from the South African Demographic and Health Survey, a national cross-sectional study, revealed that 31.8% of black women studied were obese, 26.7% were overweight and 43.4% had central obesity.[7]

Conversely, the devastating HIV/AIDS epidemic is causing havoc in South Africa, which remains host to the largest number of HIV-infected persons in the world.[17] In the most recent survey conducted among women attending antenatal public health clinics in all nine provinces, the Free State emerged as the province with the third highest prevalence rate (32.9%) of HIV.[18] The South African National HIV Prevalence, Incidence, Behaviour and Communication Survey, a cross-sectional household survey, revealed that in 2008, 10.9% of all South Africans older than two years of age were infected with HIV.[19]

Although an array of factors contributes to HIV infection, poverty has been identified as a major determinant in developing countries such as South Africa,[20,21] where it affects the lives of a significant proportion of the inhabitants.[22] Within this perspective, black South Africans residing in overpopulated informal settlements are exposed to certain socio-economic circumstances[23] that could increase the risk of HIV infection. Gender inequality,[24] unemployment,[20,21] migration, poor education, the low socio-economic status of black women,[20] urbanisation and female-headed households have also been reported as being influential in this regard.[25]

The prominent role of nutrition in HIV progression has been acknowledged since the disease was first diagnosed.[26] Although its effect on the anthropometric status of individuals is widely reported in other countries, very little information is available on the situation in South Africa, and specifically the Free State. Although adequate nutrition cannot prevent or cure AIDS,[1] poor nutritional status, accompanied by loss of weight, muscle tissue and subcutaneous fat,[27] may compromise immune function, thus intensifying the effect of HIV and contributing to more rapid progression of the disease.[28] Investigating the causes and prevention of HIV-related wasting therefore remains a priority, especially in populations with limited access to antiretroviral medication,[29] as in South Africa. For this reason, the South African government initiated its Operational Plan for Comprehensive HIV and AIDS Care, Management and Treatment for South Africa in 2003,[30] after the study reported in this paper was conducted.

In this paper, data on the anthropometric nutritional status of HIV-uninfected and HIV-infected women are limited to Mangaung, where this study was conducted. The authors therefore present data from a cross-sectional epidemiological study that determined the association between HIV status and anthropometrical status in women living in an urban black township in South Africa.

Method

The main objective of this study was to investigate the nutritional health of women in the age group 25 to 44 years living in Mangaung, a black residential community of the city of Bloemfontein in the Free State province of South Africa. As part of the larger study, socio-demographic status, health status as determined by a medical examination, anthropometry, prevalence of HIV, dietary intake, level of physical activity, body perception, attitude toward weight control, and prevalence and risk of lifestyle diseases were determined.

Thirteen sites in Mangaung were identified through the use of township maps, and a representative sample of 500 women living in two informal settlements (Joe Slovo and Namibia) and two formal settlements (Pahameng and Botchabela) was randomly selected to participate in the study. These four settlements were considered to be representative of Mangaung. Namibia consists of 2 995 plots, Pahameng of 1 711, Joe Slovo of 1 359 and Botchabela of 2 308. Non-pregnant, premenopausal but postpubertal women were targeted to participate. A proportionate number of the respondents (180 from Namibia, 100 from Pahameng, 80 from Joe Slovo and 140 from Botchabela) were randomly selected from these settlements. Twenty subjects were recruited per week over a 25-week period during 2000. A randomly selected residential plot was approached by a community healthcare worker who had received prior training in obtaining informed consent and explaining the purpose and procedures of the study to possible participants. One woman per selected residential plot was screened for eligibility. If nobody was at home, the residential plot to the right was targeted, and if still unsuccessful, the residential plot to the left of the original address was approached. If these attempts failed, another residential plot was randomly selected. The women participated voluntarily, after giving written informed consent. The study was approved by the Ethics Committee of the Faculty of Health Sciences, University of the Free State (ETOVS no. 02/00). Women who were unemployed and therefore home at the time of the study were probably more likely to be included in the study. A certain degree of bias therefore cannot be excluded in this regard.

Respondents were asked to abstain from ingesting food, alcohol and caffeine and to do no exercise from 22h00 the night prior to the day of assessment. Anthropometric measurements were taken in the morning and after voiding. Respondents were given an examination gown and light underwear to wear and were asked to remove their shoes. Anthropometric measurements (height and weight to determine body mass index [BMI] and waist circumference [WC]) were determined by a qualified anthropometrist, using standardised methods. Weight was determined with a SECA digital scale to the nearest 0.1 kg and height by means of a stadiometer to the nearest 0.5 cm.[31] Women were categorised as underweight (BMI less than 18.5 kg/m^2), normal weight (BMI 18.5 or over, but less than 25 kg/m^2), overweight (BMI 25 or over, but less than 30 kg/m^2) or obese (BMI 30 kg/m^2 or over).[32] Waist circumference was measured with a flexible, nonelastic tape measure to the nearest 0.5 cm. Close skin contact was maintained, without compressing underlying tissue.[31] A WC equal to or larger than 88 cm was considered high.[32] Body composition for fat was measured by means of bioelectrical impedance analysis by a qualified dietician following the prescribed procedures.[33] A fat percentage equal to or less than 8% was considered as unhealthy range (too little body fat), a fat percentage of 9–23% as acceptable lower-end

range, a fat percentage of 24–31% as acceptable upper-end range and a fat percentage equal to or larger than 32% as unhealthy (too much body fat).[31]

As part of the larger study, fasting blood samples were collected by a registered nursing sister in order to compile a comprehensive biochemical profile of each respondent. Respondents were informed that their HIV status would be determined and they were asked to give a written informed consent. Of the initial group, less than 2% of women refused to be tested for HIV. Very few women indicated that they were originally aware of their HIV status, and they were given the option of receiving their test results. HIV-infected women who chose to receive their results (less than 30%) were referred to a medical practitioner for counselling and follow-up. The research team was kept blinded to the outcome of the individual HIV tests.

HIV tests were performed on an Abbott AxSYM® System, using the Human Immunodeficiency Viruses (HIV-1/2): (Recombinant Antigens and Synthetic Peptides) Reagent Pack (Abbott, Germany, catalogue no. 3D41-20). The HIV1/2gO reagent pack was used for the in vitro qualitative detection of antibodies to HIV type 1 and/or type 2 in human serum or plasma, by using microparticle enzyme immunoassay. None of the respondents were receiving antiretroviral medication for HIV at the time of the study.

Statistical analyses

Age and HIV status groups were described and compared by nonparametric methods. Data were processed using the Statistical Analysis System™ software programme.[34] All data sets were categorised into two age groups (25–34 years and 35–44 years) and two HIV status groups (HIV uninfected and HIV infected). For each group, BMI, WC and fat percentage were described by medians (as not all data were equally distributed) and percentiles and compared by 95% confidence intervals (CIs) for the median difference, as well as the Mann-Whitney test. P-values equal to or less than 0.05 were considered statistically significant.

Results

Of the 500 women recruited for the study, 488 met the inclusion criteria. Of these, 273 were younger (25–34 years) and 215 were older (35–44 years). Of the younger women, 167 of the 273 (61%) were HIV infected, while 82 of the 215 older women (38%) were HIV infected. Four women who were found to be pregnant when examined by a medical practitioner and eight women who did not meet the age requirement were excluded from the study.

Table I illustrates the BMI of HIV-uninfected and HIV-infected women. In the younger group, the median BMI of HIV-uninfected women fell within the overweight category at 27.6 kg/m² compared to the 24.4 kg/m² of the HIV-infected women, indicating a median difference of 2.4 kg/m², which was statistically significant (CI for median difference [1.1; 3.8]; $p < 0.01$). In the older group, the median BMI of HIV-uninfected women as well as HIV-infected women fell within the overweight category and was very similar (25.0 kg/m² and 25.3 kg/m² respectively). Although a large percentage of both HIV-uninfected and HIV-infected women had a BMI within the normal range, at least 50% of all women were either overweight or obese. A significant difference was found in the distribution of BMI categories between younger HIV-uninfected and HIV-infected women, with more HIV-infected women falling in the normal weight category and fewer in the obese category ($p = 0.0199$). No significant difference was found in the distribution of BMI categories in the older group ($p = 0.9607$).

Table I: BMI of HIV-uninfected and HIV-infected younger (25–34 years) and older (35–44 years) women

					BMI categories							
Age	HIV status	Median	[a]CI	P-value	Underweight < 18.5 kg/m²		Normal weight 18.5 - 25 kg/m²		Overweight 25 - 30 kg/m²		Obese ≥ 30 kg/m²	
years		kg/m²			n	%	n	%	n	%	n	%
25–34	[b]HIV- (n = 106)	27.6			2	1.9	38	35.8	32	30.2	34	32.1
	[c]HIV+ (n = 167)	24.4	1.1;3.8	< 0.01 ([d]MBMI) 0.0199 ([e]DBMI)	5	3.0	83	50.0	50	30.1	28	16.9
35–44	HIV- (n = 133)	25.0			4	3.0	62	46.6	36	27.1	31	23.3
	HIV+ (n = 82)	25.3	-2.1;1.8	0.8878 (MBMI) 0.9607 (DBMI)	5	6.1	33	40.2	23	28.1	21	25.6

a = confidence interval
b = HIV uninfected
c = HIV infected
d = MBMI: Median BMI
e = DBMI: Distribution of BMI

Table II: Waist circumference of HIV-uninfected and HIV-infected younger (25–34 years) and older (35–44 years) women

					Waist circumference			
Age	HIV status	Median	[a]CI	P-value	< 88 cm		≥ 88 cm	
years					n	%	n	%
25–34	[b]HIV- (n = 106)	77.5			83	78.3	23	21.7
	[c]HIV+ (n = 167)	74.0	1;7	0.0048 ([d]MDWC) 0.0643 ([e]DWC)	145	86.8	22	13.2
35–44	HIV- (n = 133)	79.0			100	75.2	33	24.8
	HIV+ (n = 82)	78.0	-6;2	0.3326 (MDWC) 0.7419 (DWC)	60	73.2	22	26.8

a = confidence interval
b = HIV uninfected
c = HIV infected
d = median difference in waist circumference
e = distribution of waist circumference categories

Table III: Fat percentage of HIV-uninfected and HIV-infected younger (25–34 years) and older (35–44 years) women

					Fat percentage range							
Age	HIV status	Median	[a]CI	P-value	Too little		Lower end		Upper end		Too much	
years					n	%	n	%	n	%	n	%
25–34	[b]HIV- (n = 106)	39.3			0	0	3	2.8	19	17.9	84	79.3
	[c]HIV+ (n = 167)	34.4	1.2;5.2 ([d]MDF%)	0.0016 (MDF%) 0.0581 ([e]DF%)	0	0	9	5.4	48	28.7	110	65.9
35–44	HIV- (n = 133)	38.2			0	0	6	4.5	23	17.3	104	78.2
	HIV+ (n = 82)	39.6	-3.8;1.8 (MDF%)	0.7281 (MDF%) 0.3999 (DF%)	0	0	1	1.2	16	19.5	65	79.3

a = confidence interval
b = HIV uninfected
c = HIV infected
d = median difference in fat percentage
e = distribution of fat percentage

As indicated in Table II, the median difference in WC between younger HIV-uninfected and HIV-infected women was 3.5 cm, which was statistically significant (CI for median difference [1;7]; p = 0.0048). A close-to-significant difference was found in the distribution of WC categories between younger HIV-uninfected and HIV-infected women, with more HIV-infected women having a WC < 88 cm and fewer having a WC ≥ 88 cm (p = 0.0643). In the older group, no significant difference was found in the WC of HIV-uninfected and HIV-infected women (p = 0.7419).

The median fat percentage, regardless of age or HIV status, fell within the unhealthy category (indicating excess body fat) and ranged between 65.9% in younger HIV-uninfected women and 79.3% in older HIV-infected women (see Table III). The median difference in fat percentage between HIV-uninfected and HIV-infected younger women was statistically significant (CI for median difference [1.2;5.2]; p = 0.0016). In the older group, no significant difference was found between HIV-uninfected and HIV-infected women (CI for median difference [-3.8;1.8]; p = 0.7281). A close-to-significant difference was found in the distribution of fat percentage categories between younger HIV-uninfected and HIV-infected women (p = 0.0581), with fewer HIV-infected women falling in the unhealthy range category and more HIV-uninfected women falling in this category (too much body fat). In the older group, no significant difference was found in the distribution of fat percentage categories between HIV-uninfected and HIV-infected women (p = 0.3999).

Discussion

This cross-sectional study conducted in the year 2000 depicts data from the most recent study of the anthropometric nutritional status of HIV-uninfected and HIV-infected, but antiretroviral-naïve, women in Mangaung, in the Free State province of South Africa. The random study sample included all women that met the criteria for inclusion, as explained in the Method section. This implies that women suffering from self-reported diseases and those manifesting with ailments or diseases diagnosed during the

examination by a medical practitioner were included in the study. Very few of the women were aware of their HIV status at the time of the study. Although the women's HIV status was determined, clinical disease stage and CD4 cell count were not investigated.

In this paper, the authors compare the anthropometric measurements of HIV-infected and HIV-uninfected women. HIV prevalence was found to be remarkably high, with 61% of women between 25 and 34 years of age and 38% of women between 35 and 44 years of age infected with the virus. Statistics from the 2008 South African Department of Health Report[18] revealed that among women attending antenatal clinics, there was an infection rate of 23.8% among those aged between 25 and 29 years, and an infection rate of 14.6% among those aged between 30 and 34 years. Prevalence was lower among women in the age group 35 to 39 years (8.0%) and among those between 40 and 44 years of age (2.1%). Almost 90% of the HIV-infected women included in that study were black. In the 2008 South African National HIV Prevalence, Incidence, Behaviour and Communication Survey, a cross-sectional household study that included all South African races, 32.7% of women aged between 25 and 29 years, 29.1% of those aged between 30 and 34 years, 24.8% of those aged between 35 and 39 years, and 16.3% of those aged between 40 and 44 years were found to be HIV infected. HIV infection was found to be more prevalent among female respondents than male respondents in all the age categories.[19] Similarly, the results from the study reported in this paper confirm the well-established fact that young women are more prone to HIV infection. Since women who were unemployed or at home due to ill health were probably more likely to be included in the study, a certain degree of bias cannot be excluded in this regard.

In addition to the high rate of HIV infection, the alarming rate of overweight and obesity among the South African population has become a critical health issue. This phenomenon is clearly reflected in the results of the present study, which in 2000 found more than 50% of all black women studied to be overweight or obese. Although these figures might have changed in the years since the study was conducted, no recent data on this phenomenon in the Free State or Mangaung have been published. As described in separate publications emanating from the study, the authors relate this to urbanisation accompanied by a modern diet overloaded with kilojoules, animal fats and low-fibre carbohydrates,[35] as well as a lack of physical activity.[36] The South African Demographic and Health Survey found more than 26% of black women to be overweight and almost 32% to be obese, while approximately 43% had a WC exceeding 88 cm. That study also found that obesity increased with age and that in urban areas, black women had higher levels of obesity than women of other races.[7] A WC equal to or over 88 cm in women poses a higher risk for metabolic complications such as heart disease, stroke, type 2 diabetes and hypertension.[1]

Of the 44 black female community health workers who participated in a study in Khayelitsha, a large township community of the city of Cape Town, South Africa, 25 were found to have a BMI between 30 and 40 kg/m^2 and 15 demonstrated a BMI equal to or higher than 40 kg/m^2. A mean WC of 110 cm was reported. Socio-cultural, behavioural and environmental factors were indicated as possible contributors to obesity among these health workers.[37] In another study conducted in the same township, high rates of overweight (24.7%), and in particular obesity (53.4%), were found among black women, while 71.5% of the women displayed abdominal obesity.[16] Despite the high prevalence rates of overweight and obesity reported in this paper, the fact that at least 73% of all women studied had a WC under 88 cm is commendable. A survey conducted by Mollentze et al in one partly rural and one urban black area in the Free State indicated that in the rural area, between 27.5% and 49% of women were obese, while in the urban area the figure was between 31.1% and 54.3%.

Those authors emphasised the urgency of population-directed preventive measures to avoid an epidemic of atherosclerotic disease in this population.[38] Although lower than in the aforementioned studies, results from the Transition and Health during Urbanisation of South Africans (THUSA) study conducted in the North West province of South Africa also confirmed high prevalence rates of overweight (25.2%) and obesity (28.6%) among black women.[11] As reported in a separate publication emanating from our study,[36] and also according to the THUSA study, lack of physical activity may be a profound contributor to this trend.[12] Another critical factor related to obesity is the misconception that being thin is a sign of HIV/AIDS infection,[37] a well-known social stigma in South African communities. As reported in a separate publication emanating from the study, which investigated perceptions of body size, an overweight body was perceived as attractive and healthy. Such perceptions were possibly influenced by social and cultural factors.[39]

In contrast to the ever-increasing incidence of obesity, the typical pattern of unintentional weight loss and wasting, characterised by lean body-mass depletion with a decrease in skinfold thickness and mid-arm circumference, is a common but serious indicator of HIV/AIDS infection,[40] associated with a poor disease prognosis and a low survival rate.[41] These adverse anthropometric outcomes can result from an array of factors such as inadequate food intake, malabsorption, metabolic disturbances, uncontrolled opportunistic infections and lack of physical activity.[40] However, major nutritional changes are typical of the AIDS disease stage and are uncommon in clinically stable

persons.[42] Results from the selected metabolic parameters described in a separate publication emanating from this study confirmed that respondents were possibly in an early stage of HIV infection, impacting only on serum protein and serum albumin.[43]

There is evidence that the anthropometric profile of HIV-infected individuals can vary widely. Increased levels of obesity, associated with an unbalanced diet and poor lifestyle choices, have been noted for HIV-infected young adults in the USA, where population-wide obesity is also well recognised.[44] Data from another USA study indicated that more than 20% of HIV-infected women were obese and 50% were overweight.[45] Notwithstanding the significantly higher intake of energy of the young HIV-infected women compared to their HIV-uninfected counterparts indicated in a separate publication of our study,[35] the median BMI of HIV-infected younger women was significantly lower (but still within the normal BMI range) than that of the HIV-uninfected younger women. The insignificance of differences in anthropometric variables of older HIV-uninfected and HIV-infected women may be related to their stage of disease (which was not determined).

Although weight loss was not measured in this survey, it could be argued that these women were possibly increasing their energy intake in an attempt to compensate for their loss of weight. Similarly, results from an international study confirmed that HIV-infected men[46] and women with the highest energy intake also had the lowest BMI,[26] which the authors ascribed to metabolic changes and an increase in viral load.[26] Nevertheless, HIV-infected individuals with a baseline BMI above 25, as seen in the older HIV-infected women included in the study, have a greater chance of survival than those with a lower BMI,[45] highlighting the importance of weight maintenance in such individuals.[47] In contrast to the results of the current study, as reflected in this paper, no significant differences in anthropometric variables and nutrient intake between asymptomatic and healthy black South Africans were found in the THUSA study.[48] In another Free State study, a median BMI value of 22.7 was recorded for black HIV-infected women. Moreover, male and female patients with $CD4^+$ T cell counts below 199 cells/mm^3 were found to be leaner than those with higher counts, indicating more weight loss in the advanced disease stage.[49] Mulligan et al found that HIV-infected men with a lower body fat content at the onset of wasting lost more lean body mass than those with a higher body fat percentage, confirming that the loss of body mass depends on the percentage of body fat prior to weight loss.[50] In HIV-infected women, lean body mass was found to be independent of the initial body fat percentage in those with a normal to high body-fat percentage who demonstrated disease-related weight loss.[29]

As reflected in this paper, the high mean body fat percentage of most women included in the study, regardless of age or HIV status, is worrisome. Furthermore, inadequate levels of physical activity[36] and the consumption of a diet high in energy and macronutrients, as reported elsewhere, were predominant features in the cases of the majority of these women.[35] It has been confirmed that women lose more body fat than lean body mass during the early and advanced stages of wasting,[40] possibly as a result of the higher fat percentage at the onset of HIV. This could possibly explain the significant difference in median fat percentage between the HIV-infected younger women and their HIV-uninfected counterparts.

In the early stage of HIV disease, the impact of the disease on anthropometric variables may not be as significant as expected, especially in women who were initially obese. Determining the percentage of weight loss over time (which we did not do) may be more important than measuring only the current BMI.

Conclusions

The results of the study indicate that the prevalence of HIV infection was high in Mangaung in the year 2000, especially among younger women. However, the HIV-infected women were possibly in an early disease stage, prior to physical deterioration, and unaware of their HIV status. In both HIV-uninfected and HIV-infected women, the prevalence of obesity was high, as indicated by BMI and fat percentage. However, the BMI, WC and fat percentage of HIV-infected younger women were found to be significantly lower than those of HIV-uninfected younger women. The fact that the majority of women were unaware of their HIV status and also unwilling to obtain their HIV results poses significant challenges in terms of recommendations for lifestyle. There is an urgent need for a sustainable strategy to combat the prevalence of overweight and obesity in the Mangaung community. The support of a comprehensive, community-based intervention programme is required in this regard.

In addition, an increase in physical activity can help to preserve lean muscle mass in HIV-infected women.[47] Review studies[51] have confirmed that an intensive and extended exercise programme can be a safe and rewarding way in which to improve their quality of life. Preserving the BMI of HIV-infected women by maintaining their current energy intake, with specific emphasis on the value of healthy eating practices, should be encouraged to compensate for unintentional weight loss at a later stage of the disease.

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