

The risk of developing malnutrition in people living with HIV/AIDS: Observations from six support groups in Botswana

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Abstract

Objectives: The objectives of this study were 1) to determine the proportion of people living with HIV/AIDS (PLWHA) at risk of developing malnutrition, 2) to determine the prevalence of malnutrition (BMI < 18.5 kg/m²), and 3) to describe the dietary intake and other nutrition parameters of PLWHA with membership in support groups.

Design: Descriptive cross-sectional study.

Setting: Six support groups in Gaborone and neighbouring locations.

Subjects: Consenting, free-living HIV-positive adults 20 to 50 years of age with membership in support groups for PLWHA.

Outcome measures: The subjects' risk of developing malnutrition was established using a modified subjective global assessment (SGA) screening tool. Subjects with an SGA score ≥ 4 were classified as being at high risk of developing malnutrition.

Results: From 145 PLWHA screened, 47.5% (n = 69) were found to be at high risk of developing malnutrition (SGA score ≥ 4) and 28.5% (n = 41) were malnourished (BMI < 18.5 kg/m²). In the sample with SGA scores ≥ 4 , 52.2% (n = 35) presented with a BMI < 18.5 kg/m². These two groups also reported more unintentional weight loss, gastrointestinal symptoms, and other conditions commonly associated with a high risk of developing malnutrition. PLWHA with membership in support groups also had low educational attainment and high unemployment rates. A total of 47% of subjects with an SGA score ≥ 4 needed food assistance.

Conclusions: Almost 50% of PLWHA with membership in support groups for PLWHA are at risk of developing malnutrition, while about 30% have a BMI < 18.5 kg/m². Nutrition screening can also help to identify those PLWHA with a BMI > 18.5 kg/m² who are still at high risk of developing malnutrition. Timely nutrition interventions can therefore be instituted in order to prevent deterioration in nutritional status.

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Introduction

Opportunistic infections place PLWHA at a high risk of developing malnutrition.¹ Malnutrition, defined as BMI < 18.5 kg/m²,¹ is especially likely in settings where poverty and poor access to care prevail. Without prompt attention, malnutrition and opportunistic infections can worsen disease progression and prognosis through mechanisms that include but are not limited to higher metabolic rate, malabsorption, impaired food intake and metabolic aberrations.^{2,3} Routine nutrition screening can facilitate prompt treatment and dietary interventions, which in turn can reduce the frequency and duration of opportunistic infections as well as prevent weight loss.⁴⁻⁶ Research observations suggest that unintentional weight loss can progress even when nutrition interventions are provided. However, nutrition interventions early in the disease course or before the development of opportunistic infections can prevent unintentional weight loss successfully.^{4,5} Such timely nutrition interventions can only be feasible if free-living PLWHA are routinely screened for malnutrition. Unfortunately, this important care component is not readily available to all PLWHA.

Routine nutrition screening in PLWHA is particularly important in Botswana because of the large number of PLWHA in this country. In Botswana, the national HIV prevalence for persons 18 months and older in 2004 was estimated at 17.1%⁷ with prevalence rates as high as 33%, 40.2% and 35.9% for adults between 25 and 29, 30 and 34, and 35 and 39 years respectively.⁷ Botswana is clearly one of several sub-Saharan African countries with high proportions of PLWHA. There is strong government commitment to the treatment, care and support of PLWHA, as evidenced in part by government provision of antiretroviral drugs and food baskets to qualifying clients. However, even with these measures in place, there are gaps that need to be addressed. In particular, there is little information on the nutritional status of PLWHA, despite the critical role of nutrition in disease progression.

The prevalence of malnutrition in PLWHA in Botswana is unknown. Routine nutrition screening is not readily accessible to PLWHA due to the shortage of dietitians in government clinics, primary hospitals and infectious disease centres. Healthy eating guides for PLWHA and nutrition and HIV/AIDS guidelines for providers caring for PLWHA have been developed to address some of these challenges; their

utilisation and impact, however, remain unknown.⁸ To some extent the utilisation of these aids can be facilitated by the awareness of PLWHA of their nutrition risk. This requires access to dietary and nutrition screening tools, particularly those tools with indicators that can be easily understood and used by most people, including PLWHA themselves. Among such indicators, unintentional weight loss is a strong predictor of disease progression and mortality in PLWHA.⁹ The frequency and overt nature of unintentional weight loss in HIV-positive adults lend it amenable for use in nutrition screening tools and as the focus of preventive nutrition education and interventions. The importance of routinely screening PLWHA with tools with such indicators cannot be overemphasised.

To examine some of these gaps, data were collected from free-living HIV-positive adults who are members of support groups of PLWHA. The objectives of this study were to determine the proportion of PLWHA at risk of developing malnutrition as well as the prevalence of malnutrition (BMI < 18.5 kg/m²) and to describe the dietary intake and other nutrition parameters.

Methods

A cross-sectional descriptive study of HIV-positive adults with membership in support groups of PLWHA was carried out between June and December 2006. Of the 16 support groups in the June 2006 list of support groups registered with the Botswana Network of People Living with HIV/AIDS in Gaborone and neighbouring villages, six were contacted. Only one support group per Gaborone or village locality was selected. Of the consenting support groups, all consenting adults were enrolled. A total of 145 adults aged 18 to 50 years were enrolled from the six support groups. To be eligible for inclusion, participants were to be free-living (not hospitalised or bed-ridden), able to attend support group meetings and agree to nutrition screening. Further, if found to be at high risk of developing malnutrition, participants were to agree to undergo thorough nutrition assessment that included assessment of dietary intake using the 24-hour dietary recall methodology, measurements of triceps skinfolds (TSFs) and mid-upper-arm circumference (MUAC) and to provide blood samples for serum albumin analysis. Once enrolled, subjects' nutrition screening and demographic information were obtained on site and if necessary, arrangements were made for their transportation to the medical laboratory for collection of blood samples within a week of enrolment. The usual meeting sites of the individual support groups were identified as suitable locations for this study, because members operated on the principle of shared confidentiality and as such, issues of possible stigmatisation were greatly minimised. Study instruments were pilot tested on 10 PLWHA. The data were collected by two trained research assistants. The research assistants participated in the pilot testing of the instruments and in the actual data collected under the supervision of a registered health professional.

The subjects' body weights were measured to the nearest 0.1 kg using Seca Scales (Seca Scale Model 750 1019009, Vogel and Halke, Germany). They were wearing one layer of light outdoor clothing and had to remove their shoes. Height measurements were taken by a stadiometer procured from Scale 2000 (Attached height stick, model PSWHA, procured from Scale 2000, Box 7456, Rochdal Park, 4034 Durban). Measurements were read to the nearest 0.1 cm. Skinfold

measurements were taken using the Harpenden Stainless Steel calipers. Subjects' skinfold measurements were an average of three measurements, each read to the nearest 0.2 mm.

A modified and scored SGA tool was used to screen the subjects (available as an addendum at www.sajcn.co.za). Questions in the tool screened subjects for any changes in dietary intake and body weight in the past six months, history of gastrointestinal illnesses, signs and symptoms of malnutrition, reported history of treatment for tuberculosis (TB) (prophylactic or active) and history of HIV or treatment for HIV. Subjects were considered to be at low risk of developing malnutrition if they had a score of 0 to 3 from at least three different categories and to be at high risk of developing malnutrition if they had an SGA score ≥ 4 . The researcher decided on a low-risk cut-off point of 3 because it was less than half the maximum possible score (8) of the categories in the screening tool. This being the first study using the modified SGA tool in this population, there was no prior work that could inform the qualification of the risk of developing malnutrition as low, moderate or high-risk. Data collected by the screening tool were self-reported.

To accommodate adults with low numeracy skills, the SGA tool was simplified by modifying the weight loss and dietary intake criteria. Any unintentional weight loss, rather than a specific value of 10%, and any change in dietary intake (including changes in appetite, difficulty eating some foods or avoidance of some foods) were defined as high-risk. Furthermore, physical examinations such as screening for loss of subcutaneous fat, muscle wasting, oedema and ascities that required expertise that may not be available in some settings were excluded. Data captured with the SGA tool and the socioeconomic questionnaire were analysed using SPSS 14.01, while the FoodFinder™ was used to analyse dietary data.

Following the data collection, subjects were helped by the research assistants to understand their SGA score and risk of developing malnutrition. Subjects with an SGA score ≥ 4 were seen by a health professional and given dietary counselling to address areas of concern as revealed by the screening tool. Subjects were further encouraged to share the findings of the SGA screening tool with their health provider at their next clinic/hospital visit.

Results

Subject characteristics: Data were available for 145 subjects from the 6 support groups. The mean age of participants was 33.2 ± 6.7 years. Most participants (83.4%; $n = 121$) were women. The nutrition and demographic characteristics of subjects are illustrated in Figure 1. As illustrated, 91.4% ($n = 128$) of subjects were unemployed and 67.2% ($n = 94$) had less than seven years of formal education. While more than one-quarter (28.5%; $n = 41$) of subjects had a BMI < 18.5 kg/m², 47.5% ($n = 67$) had an SGA score ≥ 4 and were therefore classified as being at risk of developing malnutrition.

Among subjects with an SGA score ≥ 4 , 47.0% ($n = 31$) were beneficiaries of food baskets (social services) while 15.7% ($n = 8$) had low albumin levels.

The screening results revealed that 54.5% ($n = 77$) (Figure 2) of all subjects reported experiencing unintentional weight loss of any degree, while 42.2% ($n = 59$) reported a history of gastrointestinal symptoms. Episodes of diarrhoea and vomiting were reported by

Figure 1: Socio-demographic and health characteristics of subjects

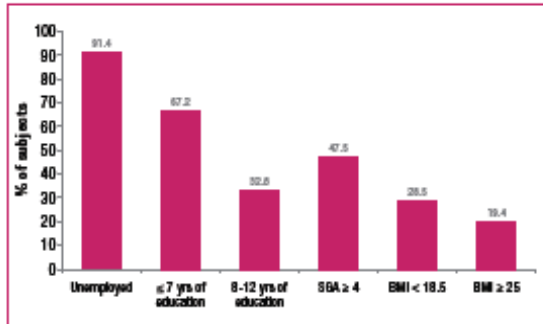
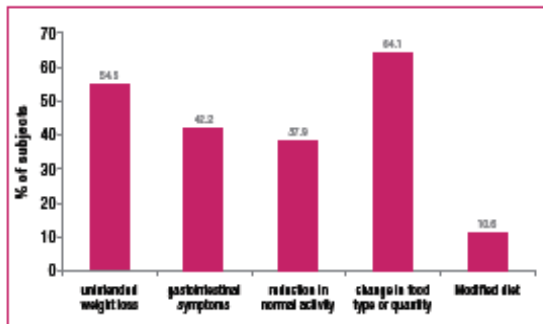


Figure 2: Reported history of health and dietary concerns



23.4% (n = 33) and 18.8% (n = 26) of subjects respectively. These symptoms (Table I) were reported more frequently by subjects with an SGA score ≥ 4. Similarly, unintentional weight loss was reported by 74.6% (n = 50) of subjects with SGA scores ≥ 4 compared to 36.5% (n = 27) of those with a score ≤ 3. Similar differences

Table I: Nutrition-related characteristics of participants with different SGA scores

	Percentage of subjects (n)	Percentage of subjects with SGA 0–3	Percentage of subjects with SGA ≥ 4
History of gastrointestinal symptoms? ($\chi^2 = 27.93$; df = 2; $p < 0.001$)			
Diarrhoea	42.2 (59)	25.7 (19)	59.7 (40)
Vomiting	23.4 (33)	23.0 (17)	25.7 (16)
None	18.8 (26)	2.7 (2)	35.7 (24)
History of unintentional weight loss? ($\chi^2 = 20.64$; df = 1; $p < 0.001$)			
No	58.2 (82)	74.3 (55)	38.6 (27)
Yes	42.2 (59)	25.7 (19)	59.7 (40)
Have modified diet? ($\chi^2 = 14.129$; df = 1; $p < 0.001$)			
No	89.4 (126)	98.6 (73)	79.9 (53)
Yes	10.6 (15)	1.4 (1)	20.9 (14)
Change in food type or quantity? ($\chi^2 = 16.582$; df = 1; $p < 0.001$)			
No	35.5 (49)	51.4 (37)	18.2 (12)
Yes	64.5 (89)	48.6 (35)	81.8 (54)
Body Mass Index ($\chi^2 = 77.00$; df = 2; $p < 0.001$)			
<18.5	28.6 (40)	6.8 (5)	52.2 (35)
18.5–24.9	51.4 (72)	63.0 (46)	38.8 (26)

between subjects with high or low scores on the SGA screening tool were observed with regard to the history of gastrointestinal illnesses, changes in food type or quantity and other dietary modifications.

As summarised in Table I, 52.2% (35) of subjects with an SGA score ≥ 4 had a BMI < 18.5 kg/m² compared to only 6.8% (n = 5) of subjects with an SGA score ≤ 3. The prevalence of BMI < 18.5 kg/m² was at least seven times higher in PLWHA with SGA scores ≥ 4 compared to those with SGA scores < 3. More subjects with an SGA score ≥ 4 reported changes in the type and quantity of food they had eaten and/or other dietary modifications than subjects with an SGA score ≤ 3.

The relationship between BMI and factors associated with nutritional status is displayed in Table IIa. As summarised, the data shows a higher frequency of unintentional weight loss, changes in dietary intake and gastrointestinal symptoms in subjects with a BMI < 18.5 compared to those with a normal BMI. In addition and as illustrated in Table IIb, BMI was significantly negatively associated with SGA scores ($r = -0.31$; $p < 0.01$) but significantly positively associated with MUAC ($r = 0.70$; $p < 0.001$) and TSF ($r = 0.61$; $p < 0.001$). (TSF results are not displayed as they provided the same information as that of the MUAC.) Therefore, the lower TSF, MUAC and BMI results in subjects with a modified SGA score ≥ 4 suggest the possibility of protein energy malnutrition in this group.

Table IIa: Occurrence of risk factors by subject BMI

BMI	< 18.5 % (n)	18.5 – 24.9 % (n)	≥ 25 % (n)	Total % (n)
Unintentional weight loss? ($\chi^2 = 14.706$; df = 2; $p < 0.001$)				
No	29.3 (12)	41.2 (31)	75.0 (21)	44.4 (64)
Yes	70.7 (29)	58.7 (44)	25.0 (7)	35.6 (80)
Gastrointestinal symptoms? ($\chi^2 = 10.110$; df = 2; $p < 0.01$)				
No	29.3 (12)	41.2 (31)	75.0 (21)	44.4 (64)
Yes	70.7 (29)	58.7 (44)	25.0 (7)	35.6 (80)
History of changes in dietary intake? ($\chi^2 = 4.724$; df = 2; $p < 0.05$)				
No	22.5 (32)	39.2 (69)	44.4 (28)	35.5 (50)
Yes	77.5 (31)	60.8 (45)	55.6 (15)	64.5 (91)

Table IIb: Comparison of mean SGA score, mid-upper arm circumference and serum albumin by BMI

Body Mass Index	Mean SGA score (n) $p < 0.001$	Mean MUAC [cm] (n) $p < 0.01$	Mean albumin (SD) $p < 0.05$
< 18.5	5.3 ± 2.1 (40)	22.5 ± 2.6 (26)	38.4 ± 5.1 (25)
18.5–24.9	3.2 ± 1.7 (72)	25.2 ± 4.3 (22)	41.8 ± 4.7 (22)
≥ 25	2.3 ± 1.5 (28)	33.2 ± 4.7 (5)	40.3 ± 5.1 (5)

24-hour dietary recall observations: 24-hour dietary intake data were collected from 75 participants with SGA scores ≥ 4. The distribution of total energy intakes of subjects was examined in a scatter plot, and all those that deviated from the rest of the subjects were classified as outliers and excluded from the analysis. This left dietary recalls from 51 subjects available for analysis. In establishing reasons for the divergence of the estimated energy intakes of participants identified as outliers, it became apparent that most had missed at least one meal. The possibility that the energy intake of

subjects classified as outliers was reflective of their typical day's intake could be seen as a limitation of the study, but as it nonetheless substantially deviated from other subjects' intake, it was excluded from this analysis. These cases will be studied separately, as they could be suggestive of the existence of a distinct sub-population of PLWHA.

The estimated energy and macronutrient intake for these subjects are displayed in Table III. The mean estimated energy intake of subjects was 7 300 kJ; (7 000 kJ for men and 7 300 kJ for women). On average the estimated intake was about 75% of the median energy requirement set for healthy adults 18 years and older.¹⁰ No significant differences were observed between energy and macronutrient intake between men and women.

The mean protein intake was estimated at 53 g (48 g for men and 53.9 g for women). At the observed energy level the proportion of energy from protein (12%) and fat (16%) for women fell within the acceptable macronutrient distribution range (AMDR) for healthy adults (10–35% for protein and < 30% for lipids). For men, the actual protein intake was lower than recommended. The proportion of energy from carbohydrates of 66% was on the higher end of the AMDR.¹⁰ The average amount of carbohydrates consumed was 284 ± 117 g. The observed amount of fibre intake of 20 g/day was lower than recommended. The amount was unexpectedly low given the observed intake of carbohydrates.

Table III: Mean energy and macronutrients intakes estimated from 24-hour dietary recalls

Macronutrients	n	Mean (std dev)	% AER1/AMDR (std dev)
Energy (kJ)	51	7 288(2 856)	75 (31)
Protein (g)	51	53 (22)	12 (4)
Animal protein (g)	43	18(16)	
Fat (g)	51	30 (20)	16(8)
Fibre (g)	52	20 (14)	

1 The estimated energy level was compared to the acceptable energy requirement for adults.

Discussion

The purpose of this study was to determine the proportion of PLWHA at risk of developing malnutrition, to determine the prevalence of BMI < 18.5 kg/m² and to describe the dietary intake and other nutrition parameters of PLWHA with membership in support groups for PLWHA. The study found that about 30% of adults in this population had a BMI < 18.5 kg/m² and could be classified as malnourished. In adults identified as being at high risk of developing malnutrition through the modified SGA screening tool, the frequency of subjects with a BMI < 18.5 kg/m² was even higher (52%). Consistent with observations from other studies, unintentional weight loss and gastrointestinal illnesses, especially diarrhoeal illnesses and vomiting, plagued significant proportions of adults in this population⁹ and are likely to have contributed to the BMI values observed in this study. Indicative of the extent of malnutrition and also possibly the disease stage, serum albumin levels were also decreased in 15.7% of those classified as being at high risk of developing malnutrition by the screening tool.⁹ Low albumin levels, as is the case with significant unintentional weight loss, is a nutrition indicator that also reflects disease stage and prognosis in HIV/AIDS.¹² These observations suggest the possibility of protein energy malnutrition in a large proportion of subjects in this sample.

With the exception of anthropometric assessments, nutrition screening in this study relied largely on self-reported information and symptoms (e.g. reported unintentional weight loss and gastrointestinal symptoms). These self-reports proved to be reliable. The modified SGA scores were significantly associated with both BMI < 18.5 kg/m² and albumin levels, which are more objective indicators. Nonetheless, the modified SGA tool tended to overestimate the proportion of subjects classified as being at high risk of developing malnutrition. Subsequent work should focus on improving the specificity of the tool by improving descriptors used in the screening questions, while at the same time preserving the tool's ease of comprehension by clients and ease of use by most providers.

Consistent with the prevalence of BMI < 18.5 kg/m², subjects' diets were generally inadequate in energy and predominately starchy. The average energy intakes of adults with an SGA score ≥ 4 was estimated at 7 300 kJ/day, constituting only 75% of dietary reference values for energy for healthy active adults.¹⁰ The observed energy intakes are grossly inadequate for people living with HIV/AIDS whose energy requirements are typically adjusted upward of values for healthy adults by at least 10 to 30% to meet the energy demand for increased metabolic rate, malabsorption and metabolic aberrations observed in HIV-positive adults at different disease states.¹³ At the very minimum, the average energy intake of adults in this population should fall within an acceptable range of the energy estimate for moderately active asymptomatic HIV-positive adults.¹³ At 12% the mean proportion of energy from proteins seemed to have been within the AMDR of 10 to 35% of energy.¹⁰ However, given that energy intakes were low, the actual amount of proteins (grams of protein) estimated from the 24-hour dietary recalls was lower than recommended (53 g versus 56 g) for men but within the acceptable range for women. Food intake also seems to have been a challenge. This is suggested by the high proportions of subjects who reported changes in the amount and types of food they eat compared to what they used to eat before seroconversion.

Food insecurity was not assessed directly in this study, but if the proportions of adults in need of and on food assistance programmes are used as proxy-indicator for food insecurity, given the frugal procedures for identifying programme recipients in Botswana,^{14,15} food insecurity was a likely problem in this population. It is government policy that recipients of the food baskets undergo rigorous assessment by social workers. This entails home visits to establish that clients have no reliable income, limited financial reserves or no significant assets to qualify for assistance.¹⁵ Therefore, the fact that 47% of subjects in the group at high risk of developing malnutrition (SGA score ≥ 4) qualified for food assistance suggests that the extent of food poverty in this population group could be high. For some, food poverty might have been transient because illnesses in PLWHA are known to interrupt gainful employment,¹⁶ while others may have been food-insecure even before seroconversion. Both of these situations need to be addressed, because poverty is one of the factors in the causal pathways of the spread of the HIV in Africa¹⁷ and it also negatively impacts survival. While subjects' enrolment for food assistance could be indicative of food poverty, there is a need for further studies with indicators that assess food insecurity as part of nutrition and dietary screening to further refine the screening tool and guide the formulation of comprehensive interventions for

PLWHA. There is also a need to study a subset of PLWHA whose dietary energy intake was found to be substantially different from the rest of the sample to warrant their classification as outliers. Most of these subjects had missed at least one meal and are conceivably in a worse situation than other PLWHA. For such a sub-population group, dietary observation reported in this study will most likely be an overestimate.

The high proportion of adults with a low level of educational attainment in support groups of PLWHA was unexpected, as the expectation would be that educational attainment for members would be reflective of national averages. These findings appear consistent with other researchers' observations,^{18,19} which show that educational attainment is negatively associated with HIV infection. The low level of education attainment, together with the high proportion of unemployment in this population, could also be indicative of poverty. There is a need for studies that examine employment issues for PLWHA in support groups. It is unclear whether the high unemployment rate in this group significantly positively influenced support group attendance, or whether other factors had greater influence on the attendance of support groups.

Conclusions and recommendations

The high proportion of free-living HIV-positive adults with malnutrition in this population is of concern. While it is understood that HIV infection and associated gastrointestinal symptoms play a role in precipitating malnutrition in this population, the diets of PLWHA in Botswana are also inadequate in energy and protein compared to recommendations for healthy people. The disparity between energy intake and recommendations become even more pronounced if the intakes of PLWHA are compared to standards adjusted for their health status. Given these observations, there is a need to routinely screen PLWHA for the risk of developing malnutrition to facilitate early detection and intervention. Screening tools, such as the SGA, with simple indicators such as unintentional weight loss, can sufficiently identify people in need of further assistance.

This study also raises questions for further exploration such as 1) the impact of food assistance programmes on the nutritional and health indicators of PLWHA; 2) the comparison of the nutritional status of members and non-members of support groups for PLWHA; 3) the impact of routine nutrition screening and intervention on the nutritional and health status of PLWHA in centres providing care and support; and 4) validation of the SGA tool for PLWHA.

While this study highlights nutrition concerns in PLWHA, the findings should be interpreted carefully. Firstly, the study used 24-hour dietary recall methodology, which is routinely used in surveys because of its low respondent burden and lack of restrictions on the numeracy and literacy rate of respondents, but is known to be less reliable compared to food records. Secondly, the reported dietary observations may overestimate the dietary intake of PLWHA who routinely skip meals for varied reasons, including poor health and depressed appetite.

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References

1. Swaminathan S, Padmapriyadarini C, Sakumar B, et al. Nutritional status of persons with HIV infection, persons with HIV infection and tuberculosis, and HIV-negative individuals from Southern India. *Clinical Infectious Diseases* 2008;46(5):945-9.
2. Sumnerbell C. Appetite and nutrition in relation to human immunodeficiency virus (HIV) infection and acquired immunodeficiency virus syndrome (AIDS). *Proceedings of the Nutrition Society* 1994;53:138-50.
3. Paton NI, Sarguetho S, Eammet A, Balunoy R. The impact of malnutrition on survival and the CD4 count response in HIV-infected patients starting antiretroviral therapy. *HIV Medicine* 2006; 7(9):323-30.
4. Chibowski RT, Grosvenor MB, Lilington L, Snyne J, Beall G. Dietary intake and counseling, weight maintenance and the course of HIV infection. *J Am Diet Assoc* 1995;95(4):428-32.
5. Stack JA, Bell SJ, Burke PA, Fosse RA. High energy, high protein nutrition supplementation in patients with HIV infection: Effect of weight status in relation to incidence of secondary infection. *J Am Diet Assoc* 1996;96(4):537-41.
6. Clinch PJ. Nutritional health: Prevention and treatment of HIV-associated malnutrition. A case manager's guide. *J Int Assoc Physicians AIDS Care* 1997;3(5):28-40.
7. National Aids Coordinating Agency. Botswana Aids Impact Survey II. Popular report. 2004:51.
8. Ministry of Health. National nutrition and HIV/AIDS guidelines for service providers of people living with HIV/AIDS. Gaborone, Botswana; 2007.
9. Chibowski RT, Grosvenor MB, Bernhard NH, Morison LS, Bulcavago LM. Nutritional status, gastrointestinal dysfunction and survival in patients with AIDS. *American J Gastroenterol* 1989;84(10):1128-33.
10. Institute of Medicine of the National Academies. Dietary reference of intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein and amino acids. Washington D.C. National Academies Press; 2002.
11. Luedy MJ, Hendricks K, Hooser R, et al. Body composition in adults infected with human immunodeficiency virus in Khon Kaen, Thailand. *Am J Trop Med Hyg* 2005;73(4):815-8.
12. Wilanon E, Saathoff E, Mugusi F, Bosch RJ, Urassa W, Fawcett WR. Weighting and body composition of adults with pulmonary tuberculosis in relation to HIV-1 coinfection, socioeconomic status and severity of tuberculosis. *Eur J Clin Nutr* 2005;59(2):163-71.
13. FANTA HIV/AIDS: A guide for nutritional care and support. 2nd edition. Food and Nutrition Technical Assistance Project, Academy for Education Development. Washington D.C.; 2004:15-7.
14. Ministry of Local Government. Guidelines for provision of social safety net for community home based care patients. Department of Social Welfare Services, Ministry of Local Government. Gaborone, Botswana; 2005:10-5.
15. Ministry of Local Government. Revised national policy on destitute persons. Social Welfare Services, Ministry of Local Government. Gaborone, Botswana; 2002:4-13.
16. Fox MP, Rose S, MacLeod MB, et al. The impact of HIV/AIDS on labour productivity in Kenya. *Tropical Medicine and International Health* 2004;9(3):218-24.
17. Mbitiriungu J. MD. Is HIV/AIDS outcomes of poverty in sub-Saharan Africa? *Creat Med J* 2007;46:905-15.
18. Barnighausen TH, Hosgood V, Tirruasu MB, Newell ML. The socioeconomic determinants of HIV incidence: Evidence from a longitudinal population based study in rural South Africa. *AIDS* 2007;21(suppl 7):S29-38.
19. Hargreaves JR, Bonell CP, Bolar T, et al. Systematic review exploring the trends in association between education attainment and risk of HIV infection in sub-Saharan Africa. *AIDS* 2006;20(5):603-14.

Addendum

The modified SGA tool used in this study B available online at www.sajcn.co.za

Addendum: Modified Subjective Global Assessment (SGA) tool

What is your malnutrition risk score?

Nutrition screening checklist based on the subjective global assessment criteria

1. History of any unintentional weight loss in past six months

No = 0

Yes = 1

2. Describe your diet

Same as before = 0

Some change in amount/type of food eaten _____ = 1*

Other changes (explain) _____ = 1*

3. History of changes in appetite?

No = 0

Yes = 1 _____ (reduced appetite)

4. History of gastrointestinal symptoms in the past six months?

No = 0

Vomiting = 1

Diarrhoea = 1

5. History of change in functional capacity in the past six months?

No Change/dysfunction = 0

Reduction in normal activity = 1

6. Basic anthropometry

BMI = 20 – 25 kg/m² = 0

BMI ≤ 18.5 kg/m² females = 1

BMI ≤ 20.0 kg/m² males = 1

7. Diseases with marked influence on nutritional needs?

HIV = 1

Cancer = 1

TB = 1

Other = 1*

None = 0

8. Any visible signs of malnutrition?

None = 0

Pale = 1, fine hair texture = 1

muscle wasting = 1, oedema = 1

angular stomatitis = 1, glossitis = 1

other (specify) = 1*

* Awarded a score of 1 only if the described factors are likely to increase the risk of developing malnutrition.

Malnutrition risk score: Add all points corresponding to items 1 to 8 above. Each category can score a maximum point of 1.

0–3 low risk of developing malnutrition

4–8 At risk for developing malnutrition