The Nutritional Status of Clinic Attendees Living with HIV/AIDS in St Vincent and the Grenadines

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ABSTRACT

Objectives: *The purpose of this study was to assess nutritional status and dietary practices in persons living with HIV/AIDS (PLWHA).*

Methods: *A case-control design was used. Cases consisted of 36 PLWHA. Controls consisted of 37 persons within the same age range from the general population. Participants filled out a questionnaire consisting of sociodemographic, dietary and health history items. In addition, they had weight, height, upper mid-arm circumference and triceps skinfold measured using standard procedure. Biochemical and clinical data for cases were extracted from their clinic file.*

Results*: HIV-positive persons had significantly lower mean weight, BMI, upper mid-arm circumferences, arm muscle area and arm fat area than persons in the control group. They were also less likely to use multivitamins, dietary supplements, fruit and vegetables than persons in the control group. Correlation coefficients between corrected arm muscle area (CAMA) and BMI and weight ranged from 0.67 to 0.74 in cases and 0.41 to 0.68 for the control group, respectively. Screening for depleted CD4 counts using gender specific CAMA cut-offs indicative of depleted arm muscle reserves resulted in 48% sensitivity and 100% specificity in identifying PLWHA with CD4 counts < 200 cells/μL.*

Conclusion*: The findings suggest that PLWHA are at increased risk for poor intakes of fruits and vegetables and depleted lean body mass. In addition, CAMA along with other clinic measures might be useful in the identification of PLWHA who might be responding adequately to treatment.*

Estatus Nutricional de Personas con VIH/SIDA Atendidas en Clínicas en San Vicente y las Granadinas

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RESUMEN

Objetivos: *El propósito de este estudio fue evaluar es estatus nutricional y las prácticas dietéticas de personas que viven con VIH/SIDA (PVVS).*

Métodos: *Se usó un diseño de control de casos. Los casos consistían en 36 PVVS. Los controles consistían en 37 personas en el mismo rango de edad de la población general. Los participantes llenaron un cuestionario contentivo de aspectos socio-demográficos, dietéticos, y cuestiones relacionadas con la historia de la salud. Además, se les determinó el peso, y se les tomó las medidas de la altura, la circunferencia del brazo medio superior, y el pliegue cutáneo del tríceps, usando procedimientos estándar***:** *Los datos bioquímicos y clínicos para los casos, fueron extraídos de sus historias clínicas.*

Resultados: *Las personas VIH positivas tuvieron un promedio de peso, IMC, circunferencias del brazo medio superior, área muscular del brazo, y área adiposa del brazo, significativamente más bajo que las personas en el grupo control. También mostraron una menor tendencia a usar multivitaminas, suplementos dietéticos, frutas y vegetales, que las personas en el grupo control. Los coeficientes de correlación entre el área muscular del brazo corregida (AMBC), y el IMC y el peso tuvieron un rango de 0.67 a 0.74 en los casos y de 0.41 a 0.68 en el grupo control, respectivamente. El pesquisaje para el conteo de células CD4 agotadas usando límites de AMBC específicos del género, indicativos del agotamiento de las reservas musculares del brazo, arrojó un 48% de sensibilidad y un 100% de especificad en la identificación de PVVS con conteos de CD4 < 200 células/μL.*

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Conclusión: *Los hallazgos sugieren que las PVVS enfrentan un riesgo mayor debido a un consumo pobre de frutas y vegetales, y a una masa corporal magra menguada. Además, la AMBC junto con las otras medidas clínicas, podría ser útil a la hora de identificar PVVS que pudieran esta respondiendo adecuadamente al tratamiento.*

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INTRODUCTION

St Vincent and the Grenadines (SVG) consist of 30 islands and are part of the Windward Island chain of the Lesser Antilles. It has an estimated area of 345 km^2 and 91% of the country's population (1999 estimated) of 111 638 live on mainland St Vincent. The first case of HIV/AIDS in St Vincent and the Grenadines was reported in 1984 and the total documented cases of HIV at the end of 2005 was 858, total AIDS cases 467 and total deaths 434. The documented number of persons living with HIV/AIDS (PLWHA) as of December 2005 was 424 (2).

Nutrition and several aspects of HIV infection are linked. The interaction between HIV/AIDS and nutritional status has been a defining characteristic of the disease since the early years of the epidemic. The rapid weight loss that accompanied the disease in the pre-antiretroviral period implied that nutrition has an important role to play in the maintenance of good health with this disease (3). HIV infection affects nutritional status by causing reductions in dietary intake, increased energy requirements, nutrient malabsorption and loss, and complex metabolic alterations that culminate in weight loss and wasting (4). The effects of HIV on nutritional status and nutritional status on HIV disease progression have been extensively studied. Studies show that micronutrient deficiencies are common in HIV disease. Low intakes of thiamine, riboflavin, niacin, vitamin B_6, vitamin E, iron, selenium and zinc are associated with more rapid progression of disease and these micronutrients seem to play a role in improving malnutrition-related immune function (5–8).

Macronutrient intakes and metabolism also play an important role in HIV disease progression. Studies have shown that the energy needs of HIV-infected individuals increase even when they show no symptoms and that opportunistic infections lead to higher protein and micronutrient utilization (9–10). Although antiretroviral therapy can contribute to the maintenance of health and avoidance of weight loss, malnutrition and wasting may still be observed in some patients. In fact, antiretroviral therapy may impair the absorption and metabolism of nutrients and in so doing, influence nutritional status and body composition (11–15). Although important roles for specific macro- and micronutrients in immune function maintenance have been identified, more recent information suggests that generalized malnutrition may explain much of the immune dysfunction that accompanies HIV/AIDS (16).

Clearly, the nutritional status of persons living with HIV/AIDS should be assessed on a regular basis in order to ascertain the level of nutrition intervention needed for maintenance or improvement of their nutritional status. Given the fact that the Caribbean ranks second to Sub-Saharan Africa in the prevalence of adults living with HIV and the importance of nutrition in slowing the progression and improving health outcomes, it is surprising to find only a few published regional studies investigating the nutritional status of PLWHA (17). This study seeks to assess the nutritional status and diet-related behaviours in persons attending special HIV/AIDS clinics in St Vincent and the Grenadines.

METHODS

A case-control design was used in the investigation. Cases (n = 36) consisted of PLWHA ages 18–50 years who were regular clinic attendees at the Milton Cato Memorial Hospital (MCMH) Kingstown, St Vincent and the Grenadines (SVG) during the period August to November 2006. Data from the clinic register indicated that 165 were registered at the clinic, however, only 98 of these regularly attend scheduled three-month visits. All clients visiting the study period were invited to participate in the study. Those who gave their consent were enrolled in the study. Controls (n = 37) consisted of volunteers matched for gender within the specified age band. Controls reported that they had never been diagnosed with the HIV. Prior to enrolment, all persons agreeing to participate were informed about the nature of the study. Participation was on a volunteer basis and participants were free to drop out of the study with no consequence to the quality of the care that they would receive in the future. The Ministry of Health and the Environment, St Vincent and the Grenadines, approved the study. Face-to-face interviews were done using a standardized questionnaire consisting of socio-demographic, health history and nutritional items. Dietary intakes were determined using a food frequency questionnaire. Information on the most recent CD4 count of PLWHA was extracted from their clinic files. All measurements of anthropometry (height, weight, waist and hip circumferences) were done according to standard procedures (18). The participants had their heights measured to the nearest 0.1 cm using a wall-mounted stadiometer. Weight was measured to the nearest 0.1 kg using a standing beam balance (Detecto Balance, USA). Body Mass Index (BMI) was calculated by dividing the weight in kilograms by the height squared in meters. Waist, hip and mid-arm circumferences were measured in centimetres using a flexible, non-stretchable measuring tape according to recommended procedures (18). Triceps skinfold measurements were taken at the same point on the arm as the upper mid-arm circumference using a calliper (SLIMGUIDE, USA). The triceps skinfold and upper mid-arm circumference was used to determine mid-

arm fat and corrected mid-arm muscle area (CAMA) using the following equations:
Arm fat area (AFA) in cm² was calculated as follows:
$AFA = [(2 \times T \times MUAC) - (\pi \times T^2)] \div 4$
MUAC = Mid upper arm circumference (cm)
T = triceps skinfold (cm)

Corrected arm muscle area in cm² was calculated as follows: $CAMA = [MUAC - (T \times \pi)]^2 \div (4 \times \pi)$; subtract 6.5 for females and 10 for males.
Corrected arm muscle area and arm fat area are known to correlate with lean body mass and percentage body fat, respectively (19). Corrected arm muscle circumference that were below the standard cut-off values of 32 cm² in males and 18 cm² in females are indicative of depleted reserves (20)

Statistical Analysis

The data were analyzed using SPSS (Statistical Package for Social Sciences for Windows version 11.0). Student's *t* test was used for the statistical significance of differences among continuous variables such as age, weight, height, BMI, upper mid-arm circumference, waist circumference, waist/hip ratio, corrected arm muscle area and arm fat area by known HIV infection status and CD4 count category. CD4 counts were grouped into two categories namely: group 1 = CD4 count < 200 cells/µL and group 2 = CD4 count ≥ 200 cells/µL. HIV positive persons with CD4 counts less than 200 cells/uL have severe HIV-related immunosuppression and are at greatest risk for the full spectrum of severe HIV-related morbidity (21). Correlation analyses were performed to determine whether the corrected arm muscle area was associated with weight and BMI. Differences in categorical variables (marital status, educational level, food frequency, perception of weight and health) were analysed by the chi-square test. The results were presented as means and percentages. Finally, sensitivity and specificity analyses were used to assess the utility of depleted arm muscle area (ie a CAMA value of 32 cm^2 in males and 18 cm^2 in females) in detecting CD4 counts below 200 cells/µL. A sensitivity of 80% indicates that the CAMA cut-off values were able to identify 80% of participants with CD4 counts below 200 cells/µL. A specificity of 90% indicates that the cut-off values were able to identify 90% of individuals with CD4 counts above 200 cells/µL when this was the case.

RESULTS

Table 1 shows the sociodemographic characteristics of participants. There were no significant differences in mean age by HIV status. The majority of participants did not live alone. Persons living with HIV/AIDS were significantly less likely than their counterparts in the control group to have completed secondary school education (OR = 8.77, 95% CI: 2.6, 30; $p < 0.001$) and to report being satisfied with their current quality of life (81% *vs* 26%; $p < 0.001$). In addition, a significantly higher proportion of them were unemployed (75% *vs* 8%). Table 2 shows anthropometry by group. PLWHA had significantly lower weight, BMI and upper mid-arm circumference, arm muscle mass and arm fat mass than persons in the control group. The prevalence of overweight

Table 1: Characteristics of participations by status

Variable	**PLWHA n = 36**	**Controls n = 37**	***p*-value**
Age	32.2 ± 10.0	34.3 ± 9.1	0.35
Female/male	19/17	19/18	
Marital Status			
Single	29 (80.6)	24 (64.9)	
Married	1 (2.8)	10 (27.0)	
Common law	4 (11.1)	1 (2.7)	
Visiting	2 (5.6)	2 (5.4)	0.9
Level of school completed			
Primary	28 (77.8)	4 (11.2)	< 0.001
Secondary	8 (22.2)	15 (40.2)	
Post secondary + tertiary	0	18 (48.6)	
Living Alone			
No	30 (83.3)	31 (83.8)	
Yes	6 (16.7)	6 (16.2)	0.9
Job Activity			
Sedentary	4 (11.1)	7 (20.0)	
Active	16 (44.4)	17 (45.7)	
Very Active	16 (44.4)	13 (34.3)	0.48
Occupational Category			
Class 1 (*eg* managers, bankers police officers, teachers)	0	14 (37.8)	
Class 2 (*eg* clerks, secretaries)	3 (8.3)	13 (35.1)	
Class 3 (*eg* masons, carpenters)	5 (13.9)	3 (8.1)	
Class 4 (*eg* labourers)	4 (11.1)	6 (16.2)	
Class 5 (occasionally employed and unemployed)	24 (66.7)	1 (2.7)	< 0.001
Current employment			
Employed	33 (92.0)	9 (25.0)	
Unemployed	3 (8.0)	28 (75.0)	0.001

Table 2: Anthropometry by group

Variable	**PLWHA n = 36**	**Controls n = 37**	***p*-value**
Weight (kg)	63.7 ± 14.0	72.9 ± 12.5	0.004
Height (cm)	167.9 ± 9.3	168.0 ± 8.9	0.93
Waist circumference (cm)	80.3 ± 9.9	83.5 ± 11.3	0.20
Hip circumference (cm)	95.9 ± 12.6	101.4 ± 14.6	0.10
Waist/Hip	84.2 ± 8.1	82.7 ± 6.1	0.38
Upper mid-arm circumference (cm)	27.2 ± 4.3	36.7 ± 6.4	0.001
Triceps skinfold (mm)	26.2 ± 8.6	28.9 ± 7.6	0.16
Arm muscle area (cm^2)	22.0 ± 10.08	34.5 ± 17.0	< 0.001
Arm fat area (cm^2)	30.8 ± 13.7	40.1± 16.0	0.01
Perception of weight			
Underweight	15 (41.7)	0	
Normal weight	19 (52.8)	28 (75.0)	$p < 0.001$
Overweight	2 (5.6)	9 (25.0)	
Changes in weight in the past 3 months (%)	22 (60.0)	18 (49.0)	0.34
BMI (kg/m^2)	22.6 ± 4.9	25.8 ± 4.0	0.003
< 18 Underweight	2 (5.6)	1 (2.7)	
18- 24.9 Normal weight	28 (77.8)	15 (40.5)	
25.0 – 29.9 Overweight	3 (8.3)	14 (37.8)	
30$^+$ Obese	3 (8.3)	7 (18.9)	0.004

and obesity was significantly higher among PLWHA compared to persons in the control group. In addition, a significantly higher proportion of them perceived themselves as underweight ($p < 0.001$). The prevalence of overweight and obesity was significantly higher among controls compared to PLWHA. Among HIV-positive persons, approximately 69% had corrected arm muscle circumference that were below the standard cut-off values (males < 32 cm², females < 18 cm²) indicative of depleted muscle mass. Of these, 76% had corrected arm muscle area that was indicative of wasting (males < 27 cm², females < 15 cm²). The use of CAMA cut-off values of < 32 cm² in males and <18 cm² in females had 48% sensitivity and 100% specificity in classifying persons with CD4 counts ≥ 200 cells/µL.

Table 3 shows dietary intakes and eating behaviours by HIV status. Persons living with HIV/AIDS had lower

Table 3: Dietary intakes and eating behaviours by group

Variable	**PLWHA n = 36**	**Controls n = 36**	***p*-value**
Importance of Nutrition			
Somewhat important	1 (2.8)	1 (2.7)	
Important	24 (66.7)	7 (18.9)	
Very Important	11 (30.6)	29 (78.4)	< 0.001
Fruit consumption			
1–2 times per week	18 (48.5)	14 (38.9)	
3–4 times per week	8 (24.2)	5 (13.9)	
5^+ times per week	10 (27.2)	18 (47.2)	0.18
Vegetable consumption			
1–2 times per week	20 (56.7)	6 (16.2)	
3–4 times per week	11 (30.0)	14 (37.8)	
5^+ times per week	5 (13.4)	17 (45.9)	< 0.001
Meals eaten			
1–2 meals/day	13 (37.1)	9 (24.4)	
3 meals/day	22 (60.0)	17 (45.9)	
4^+ meals/day	1 (2.9)	11 (29.7)	0.006
Herbal preparations	5 (13.8)	13 (35.1)	< 0.01
Multivitamins use	12 (33.3)	23 (62.2)	< 0.001
Supplement use	8 (22.2)	20 (54.1)	< 0.001

weekly vegetable intake than controls. A significantly smaller proportion of them used multivitamins, herbal preparations and dietary supplements. One-third of PLWHA had CD4 counts less than 200 cells/µL. Median CD4 count was 275 cells/µL. Among infected persons, those with CD4 counts < 275 cells/µL had significantly lower waist circumference (77.2 ± 5.2 cm *versus* 83.7 ± 11.0 cm; $p < 0.001$), waist/hip ratio (81.3 ± 5.5 *versus* 87.7 ± 9.20; $p = 0.03$) and CAMA (16.2 ± 6.0 *versus* 27.7 ± 11.6; $p < 0.001$) than infected persons with CD4 counts ≥ 275 cells/µL. Approximately two-thirds (63%) of PLWHA were on AVR therapy at the time of interview. In addition, 60% of PLWHA with CD4 counts ≤ 200 cells/µL were on ARV therapy. Finally, males living with HIV/AIDS were significantly more likely than their female counterparts to have depleted muscle mass (OR = 7.04, 95% CI: 1.6, 30.9; $p = 0.006$) and CD4 counts below the group median of 275 cells/µL (OR = 4.0, 95% CI: 1.0, 16.3; $p = 0.05$). Table 4 shows the results of correlation analyses between CAMA and MUAC and other anthropometric variable by infectious status and gender. Among female PLWHA, both CAMA and MUAC were highly positively correlated with weight, BMI, waist circumference, hip circumference and arm fat area. The correlation coefficients tended to be higher for MUAC than for CAMA. Triceps skinfold was positively correlated with MUAC but not CAMA in PLWHA. BMI was not significantly associated with CAMA among females in the control group. Among male PLWHA, CAMA and MUAC were highly positively correlated with weight, BMI and waist circumference. In addition, MUAC was significantly associated with hip circumference and arm fat area. Furthermore, the correlation coefficient between MUAC and other anthropometric variables which reached significance tended to be higher among female PLWHA than their male counterparts.

DISCUSSION

In this study, we investigated the nutritional status and dietary practices of PLWHA attending clinics in St Vincent and the Grenadines. Our findings show that compared to the control group, PLWHA were lighter and thinner. In addition, a significantly higher proportion of them had depleted muscle mass and poorer dietary practices. These mirror the findings of other relevant studies and suggest the need to place emphasis on strategies aimed at reducing and preventing malnutrition in this group (22–25). Notwithstanding the fact that PLWHA attending clinics are given a basket of basic food items on a regular basis, more needs to be done to create an enabling environment where health dietary practices can be fostered. Moreover, healthy dietary practices may help to mitigate potential impairments in absorption and metabolism of nutrients as well as the resulting changes in body composition that may accompany ARV therapy (11–15, 26). This is an important consideration among participants with HIV/AIDS in this study as 60% of them were on antiretroviral therapy at the time of the study.

Strategies to correct and prevent malnutrition among PLWHA must take into consideration the socio-economic factors that might hinder implementation of agreed action plans (27). For example, given the fact that many of the PLWHA did not have more that a primary school education, demonstrations involving the family members responsible for procuring and preparing meals as well as verbal and written instructions might be effective in improving the nutritive value of foods consumed. Such intervention strategies have been known to improve dietary practices and nutritional status of recipients (27–30). Furthermore, the fact that the majority of PLWHA were unemployed would suggest difficulties in accessing nutritious foods on a regular basis. We also recommend the distribution of minerals and vitamin supplements with the hamper that are given to clients with

Table 4: Correlation coefficient of anthropometric variables by infection status and gender

	Females Control n = 19		Female PLWHA n = 19		Males Control n = 18		Male PLWHA n = 17	
	CAMA	MUAC	CAMA	MUAC	CAMA	MUAC	CAMA	MUAC
Weight (kg)	r = 0.75 (p < 0.001)	r = 0.85 (p < 0.001)	r = 0.78 (p < 0.001)	r = 0.91 (p < 0.001)	r = 0.61 (p = 0.008)	r = 0.79 (p < 0.001)	r = 0.61 (p = 0.009)	r = 0.60 (p = 0.01)
Body mass index (kg/m^2)	r = 0.39 (p = 0.10)	r = 0.55 (p = 0.016)	r = 0.76 (p < 0.001)	r = 0.87 (p < 0.001)	r = 0.48 (p = 0.04)	r = 0.76 (p < 0.001)	r = 0.85 (p = 0.002)	r = 0.75 (p = 0.002)
Waist circumference (cm)	r = 0.71 (p = 0.001)	r = 0.92 (p < 0.001)	r = 0.84 (p < 0.001)	r = 0.91 (p < 0.001)	r = 0.65 (p = 0.003)	r = 0.83 (p < 0.001)	r = 0.64 (p < 0.005)	r = 0.58 (p = 0.014)
Hip circumference (cm)	r = 0.69 (p = 0.001)	r = 0.92 (p < 0.001)	r = 0.37 (p < 0.001)	r = 0.63 (p < 0.001)	r = 0.73 (p = 0.13)	r = 0.84 (p = 0.005)	r = 0.40 (p = 0.11)	r = 0.60 (p = 0.01)
Triceps skinfold (cm)	r = 0.60 (p = 0.007)	r = 0.88 (p < 0.001)	r = 0.22 (p = 0.31)	r = 0.77 (p < 0.001)	r = 0.27 (p = 0.27)	r = 0.64 (p = 0.004)	r = -0.47 (p = 0.06)	r = 0.21 (p = 0.42)
Arm fat area (cm^2)	r = 0.73 (p < 0.001)	r = 0.94 (p < 0.001)	r = 0.53 (p = 0.02)	r = 0.92 (p < 0.001)	r = 0.59 (p = 0.01)	r = 0.87 (p < 0.001)	r = -0.08 (p = 0.76)	r = 0.59 (p = 0.013)

CAMA = Corrected arm muscle area (cm^2) MUAC = Mid upper arm circumference

each clinic visit as a means of preventing micronutrient deficiencies in this vulnerable group. To further facilitate good nutritional practices among clinic attendees, we recommend nutritional counselling at each clinic visit. Such sessions should assist clients to develop a pragmatic approach to addressing nutritional issues relevant to the disease such as malnutrition, wasting, fat accumulation, hyperlipidaemia, insulin resistance, immune dysfunction and the possible increased risk of cardiovascular disease (31). Clearly, the member(s) of the health team responsible for addressing the nutritional implication of these co-morbidities must be familiar with the latest evidence-based research in these areas.

An important finding is the strong correlation between CAMA and weight and BMI among participants and supports the use of CAMA as a good proxy for predicting lean body mass in this population. This is important as lean body mass depletion is associated with opportunistic infection and progression of the disease (14). Moreover, the fact that triceps skinfold and MUC can be taken even when the client is unable to stand makes them useful in approximating lean body mass in bedridden clients. We have presented gender specific equations that might be used for approximating weight and BMI changes in this clinic population. The high specificity of CAMA might be useful in the identification of PLWHA who might be responding adequately to treatment. As such CAMA might be a good tool for monitoring nutritional status in this population. Finally, the results of this study suggest that males in this population appear to be at increased risk for depletion in lean body mass (23). Clearly, this should be taken into consideration in the development of strategies aimed at improving the nutritional status of clinic attendees.

The failure to randomly select participants might have resulted in a sample of HIV persons who were well enough to attend clinic during the study and might not reflect the general population of HIV/AIDS clinic attendees or the general population of PLWHA in St Vincent and the Grenadines. This type of selection bias would also affect all estimates determined in this study. In the study, the HIV/AIDS status of the control group was not confirmed by diagnostic tests. This can influence the magnitude of the differences observed between the groups. Also, the official status and length of infection is not known for most of the participants. This could have influence the nutritional status as assessed.

To summarize, we investigated the nutritional status of persons living with HIV/AIDS in St Vincent and the Grenadines by comparing them with a group of persons not known to be affected with the HIV virus. The findings suggest that compared to the general population, persons living with HIV/AIDS were at increased risk for undernutrition and poor dietary habits.

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