

# Nutritional and clinical status and dietary patterns in individuals living with HIV/AIDS in outpatient care in Sao Paulo, Brazil

*Estado nutricional, clínico e padrão alimentar de pessoas vivendo com HIV/Aids em assistência ambulatorial no município de São Paulo*

Erika Ferrari Rafael Silva<sup>I</sup>

David Salomão Lewi<sup>I</sup>

Gabriela Milhassi Vedovato<sup>II</sup>

Vânia Regina Salles Garcia<sup>III</sup>

Simone Barros Tenore<sup>I</sup>

Katia Cristina Bassichetto<sup>IV</sup>

<sup>I</sup> Disciplina de Infectologia da Universidade Federal de São Paulo (São Paulo Federal University Department of Infectious Diseases)

<sup>II</sup> Programa de Pós-graduação em Nutrição em Saúde Pública da Faculdade de Saúde Pública da Universidade de São Paulo (São Paulo University School of Public Health Postgraduate Program in Nutrition in Public Health)

<sup>III</sup> SAE DST/Aids Butantã da Secretaria Municipal de Saúde de São Paulo (City of São Paulo Department of Health STD/AIDS Specialized Service)

<sup>IV</sup> Coordenação de Epidemiologia e Informação da Secretaria Municipal de Saúde de São Paulo (City of São Paulo Department of Health Epidemiology and Information Coordinating Office)

**Source of funding:** The present study was funded by the Brazilian Health Ministry and United Nations Educational, Scientific and Cultural Organization (UNESCO), process CSV 067/06 contract SA- 2223/2006 and control UNESCO 16270.

**Correspondence to:** Erika Ferrari Rafael Silva, R Loefgren, 1588, Vila Clementino - CEP 04040 002 - São Paulo, SP. E-mail: erikaferrari@uol.com.br

## Abstract

**Introduction:** Nowadays, nutrition plays a key role in the treatment of people living with HIV/AIDS (PLHA), especially in the case of metabolic changes due to highly active antiretroviral therapy (HAART), which could be related to cardiovascular diseases (CVD). **Objective:** To describe the nutritional and clinical status and the quality of diet of PLHA. **Methodology:** A cross-sectional study was conducted with a network of outpatient care facilities for PLHA in the city of São Paulo, Brazil. The patients, undergoing HAART or not, were selected from December 2004 to May 2006, through routine clinic visits. The following were collected: socio-demographic, clinical, biochemical and anthropometric measurements and dietary data. Diet quality was evaluated according to the scores of pattern of consumption, “protective” or “not protective” against CVD. **Results:** The sample included 238 patients undergoing HAART and 76 not undergoing it. Average serum levels of total cholesterol, triglycerides and glycemia were higher in the HAART group ( $p < 0.001$ ). The majority of patients of both groups undergoing HAART and not undergoing it were eutrophic, with an average body mass index (BMI) of 24.4 ( $\pm 4.3$ ) and 24.3 ( $\pm 3.5$ ) kg/m<sup>2</sup>, respectively. The waist-hip ratio was higher among men undergoing HAART than that in those not undergoing it ( $0.90 \pm 0.06$  versus  $0.87 \pm 0.05$ ) ( $p < 0.001$ ). The group undergoing HAART showed a mean food pattern score that indicated a higher consumption of “not protective” foods against CVD ( $p = 0.001$ ). **Conclusion:** The results showed undesirable nutritional and metabolic conditions among patients undergoing HAART which were associated with CVD. Management of health interventions programs for PLHA is necessary to control cardiovascular risk factors before the outcome.

**Keywords:** HIV-1. Highly Active Highly active antiretroviral therapy (HAART). Nutritional Assessment. Dietary Patterns. Clinical Markers. Health Service Research

**Introdução.** Atualmente, a abordagem nutricional desempenha papel essencial no tratamento de pessoas vivendo com HIV/AIDS (PESSOAS QUE VIVEM COM HIV/AIDS), particularmente no caso de alterações metabólicas pelo uso da terapia antirretroviral (TARV) que podem estar associadas ao maior risco de doenças cardiovasculares (DCV). **Objetivo.** Caracterizar o estado nutricional, clínico e a qualidade da dieta de PESSOAS QUE VIVEM COM HIV/AIDS. **Metodologia.** Trata-se de um estudo transversal envolvendo PESSOAS QUE VIVEM COM HIV/AIDS em atendimento na rede de serviços especializados no município de São Paulo. Os usuários desta rede, em uso ou não de TARV, foram recrutados no período de dezembro de 2004 a maio de 2006, durante consultas de rotina. Foram coletados dados sócio-demográficos, clínicos, bioquímicos, antropométricos e dietéticos. A qualidade da dieta foi avaliada segundo escores de padrão de consumo predominantemente “não protetor” e “protetor” para DCV. **Resultados.** A amostra foi constituída por 238 pacientes em TARV e 76 sem TARV. A média dos níveis de colesterol total, triglicérides e glicemia foram maiores no grupo TARV ( $p < 0,001$ ). A maior parte dos participantes do estudo, com e sem TARV, apresentava-se eutrófica, com média de índice de massa corporal  $24,4(\pm 4,3)$  e  $24,3(\pm 3,5)$   $\text{kg}/\text{m}^2$ , respectivamente. A relação cintura-quadril foi maior entre homens em TARV que entre aqueles sem TARV ( $0,90 \pm 0,06$  versus  $0,87 \pm 0,05$ ) ( $p < 0,001$ ). O grupo em TARV apresentou média de escores indicativa de maior consumo de alimentos “não protetores” para DCV ( $p = 0,001$ ). **Conclusão.** Foram evidenciadas condições nutricionais e metabólicas indesejáveis entre aqueles em TARV, predisponentes ao risco de DCV. É apontada a necessidade de direcionamento das intervenções em saúde a PESSOAS QUE VIVEM COM HIV/AIDS, para o controle dos fatores associados a essas doenças antes do desfecho final.

**Palavras-chaves:** HIV-1. Terapia Antirretroviral (TARV). Avaliação Nutricional. Padrão Alimentar. Marcadores Clínicos. Pesquisas em Serviços de Saúde.

Advances in highly active antiretroviral therapy (HAART) have enabled the suppression of viral replication, improvement of quality of life and longevity of individuals living with HIV/AIDS, revealing lower morbi-mortality rates associated with the infection<sup>2,3</sup>. On the other hand, a variety of metabolic abnormalities have been associated with HAART and the HIV infection itself, such as changes in the distribution of body fat, insulin resistance and dyslipidemia<sup>3-6</sup>. Some of these changes are related to a higher risk of cardiovascular disease (CVD)<sup>3,6</sup>.

In addition to these factors, there are also life habits that are associated with CVD<sup>7</sup>, such as smoking and physical inactivity. In contrast, physical activity has a protective role against CVD<sup>7</sup> and it is negatively correlated to the accumulation of adipose tissue in the abdominal region of individuals living with HIV/AIDS<sup>8</sup>. High rates of prevalence of excessive weight and central obesity have recently been found in those living with HIV/AIDS, as observed in the study by JAIME *et al*, in the city of São Paulo, where there were 30.5% of overweight and 12.6% of abdominal obesity<sup>9</sup>.

Studies on food consumption and outcomes associated with higher risk of CVD have evidenced the change in the role that nutrition has in HIV infection – previously focused on the recovery from cachexia and subsequently, after the advent of HAART, on the metabolic changes related to treatment<sup>10-12</sup>. Diet composition is a factor also associated with the lipid profile and body composition of individuals living with HIV/AIDS<sup>11,13</sup>.

Nowadays, methods to evaluate the food consumption pattern of population groups are frequently used in studies that estimate the risk of chronic diseases<sup>14</sup>, enabling a broader qualitative analysis of the potential of the diet in these situations. The method of evaluation of food consumption frequency with scores was used as a useful instrument to verify the atherogenic potential of diets,

once the usual consumption of foods categorized according to the contribution to the risk of CVD was correlated to serum lipid levels<sup>15</sup>. An unsatisfactory dietary pattern has been reported in individuals with HIV/AIDS, especially in those with metabolic abnormalities<sup>13</sup> and excessive weight<sup>16</sup>.

The city of São Paulo relies on a broad *Rede Especializada em DST/AIDS* (RME DST/AIDS – STD/AIDS Specialized Network), managed by the *Secretaria Municipal de Saúde* (SMS/SP – City of São Paulo Department of Health). At the time when this study began to be designed, this network was formed by 15 specialized services and an estimated universe of 16,120 individuals living with HIV/AIDS and being actively followed, of which 8,850 were undergoing HAART. Research performed in health services is an unusual and challenging practice, especially when it involves a multidisciplinary approach. However, it is very important to analyze risk factors associated with morbi-mortality of individuals and populations in clinical and epidemiological studies<sup>16</sup>. Such factors have motivated productive partnerships between the public health service network and universities.

Justified by the lack of national data and excellent HIV/AIDS infection treatment in Brazil, the proposal of the original study was to verify the prevalence of metabolic syndrome in individuals living with HIV/AIDS, cared for in the City of São Paulo Department of Health RME DST/AIDS and the *Ambulatório da Disciplina de Infectologia da UNIFESP* (São Paulo Federal University Infectious Diseases Outpatient Clinic). In addition to describing the main metabolic changes associated with HIV/AIDS and ART use, cardiovascular risk factors were identified and shown in a publication that resulted from the original study<sup>17</sup>.

The present study aimed to describe the profile of individuals living with HIV/AIDS in the city of São Paulo, undergoing HAART or not, with an emphasis on the characterization of the nutritional, clinical and dietary pattern status, considering the risk factors for CVD.

## Methodology

### Study design and population

A cross-sectional study was conducted with individuals living with HIV/AIDS and undergoing HAART or not, followed in the *Ambulatório da Disciplina de Infectologia da UNIFESP* and in six RME DST/AIDS services affiliated with the SMS/SP<sup>17</sup>. Involvement of these services and their respective professionals with data collection occurred spontaneously.

The inclusion criteria were as follows: to have proven HIV infection in both sexes; to be aged between 20 and 70 years; to have been undergoing HAART for at least two months; or to have never undergone this treatment. Patients who had never undergone HAART were those with a CD4+ cell count between 350 and 500 cells/mm<sup>3</sup> and still asymptomatic, at the moment when they were included in the study. Pregnant women, illicit drug users, individuals with a clinical history of CVD (acute myocardial infarction and angina) and those currently using drugs with possible interference with serum lipid levels were excluded.

This study was approved by the *Comitês de Ética em Pesquisa da UNIFESP e da SMS/SP* (SMS/SP and UNIFESP Research Ethics Committees) and all participants signed an informed consent form.

### Data collection

Outpatient clinic professionals participating in this study (nutritionists, nurses, infectious diseases doctors and general practitioners) were previously trained by the research team and received an instructions guide to direct patients towards voluntary participation. Data on eligible patients, who agreed to participate in the study, were collected during routine outpatient consultations.

The following data collection instrument was used: a questionnaire about personal and family history of cardiovascular diseases, type of HAART, and socio-demographic,

clinical, biochemical and anthropometric data, developed by SILVA et al 2009<sup>17</sup>.

Blood samples were collected according to the routine protocol of outpatient services, including CD4+ T lymphocyte count and viral load, and subsequently centralized in three laboratories, two of which were affiliated with the SMS/SP and one with UNIFESP. CD4+ T lymphocyte count and viral load quantification followed the same methodology in the city of São Paulo and only the SMS/SP laboratory was used to perform biochemical dosage.

The present study was not controlled for time of use or type of highly active antiretroviral therapy. Any combinations of drugs among its several classes (nucleoside and nucleotide reverse transcriptase inhibitors – NRTI, non-nucleoside reverse transcriptase inhibitors – NNRTI, and protease inhibitors – PI) were allowed and all patients who had been undergoing HAART for at least two months were included in this study. The five most frequent ART groups found in the sample analyzed are described as follows:

Group A – AZT + 3TC + Efavirenz

Group B – AZT + 3TC + Lopinavir/ritonavir / AZT + 3TC + Nelfinavir

Group C – AZT + 3TC + Atazanavir

Group D – d4T + 3TC + Efavirenz

Group E – d4T + 3TC + Lopinavir/ritonavir / d4T + 3TC + Nelfinavir / d4T + DDI + Lopinavir/ritonavir

Anthropometric measurements were taken by nutritionists, previously trained by the *Laboratório de Avaliação Nutricional de Populações da Faculdade de Saúde Pública da Universidade de São Paulo* (São Paulo University School of Public Health Laboratory of Population Nutritional Evaluation), to guarantee the internal validity of this study. A *Guia de Técnicas de Avaliação Antropométrica* (Guide on Anthropometric Evaluation Techniques) was designed to standardize equipment calibration procedures and evaluation measurement techniques, based on the manual proposed by the above mentioned laboratory<sup>18</sup>. The use

of equipment from health services was also standardized. An anthropometric measuring tape with a 1 mm accuracy was used to measure height (m), fixed to a wall without a baseboard and perpendicular to the floor. A similar tape was used to measure waist circumference (WC), hip circumference (HC) and brachial circumference (BC). Each service used their own scale to measure body weight (kg), all of which were platform scales with a 100 g accuracy. A scientific adipometer with a 1 mm accuracy was used to measure the tricipital skin fold (TSF).

Body Mass Index (BMI) (kg/m<sup>2</sup>) was obtained to evaluate the nutritional status, using the weight divided by the square height<sup>19,20</sup>. Arm Muscle Circumference (AMC) was calculated from BC and TSF values<sup>21</sup> to evaluate brachial muscle tissue storage. The following anthropometric indicators were employed to measure body fat distribution: TSF to estimate brachial fat storage<sup>21</sup>; WC<sup>20</sup> and waist-hip ratio (WHR) to estimate abdominal fat storage<sup>22</sup>, all of which were validated for individuals with HIV/AIDS<sup>23</sup>.

A food survey was conducted by nutritionists. The method of scores proposed by FORNÉS *et al* 2002<sup>15</sup>, which identifies the frequency of consumption of foods that are predominantly “not protective” and “protective”, was adopted to evaluate food consumption. To achieve this, a Semi-Quantitative Food Frequency Questionnaire (SFFQ) was developed, related to the last 12 months and comprised of a list of 47 foods categorized into two groups, according to their nutritional composition:

Score 1: Predominantly “not protective” foods: whole dairy products; vegetable fat; animal fat; mayonnaise; heavy cream; fried foods; meats in general; offal; cold cuts; processed meat; eggs, pâté; coconut; *feijoada* (a typical Brazilian dish with black beans and pork); candies in general; snack foods.

Score 2: Predominantly “protective” foods: cereals and their products; tubers; leafy vegetables; preparations with non-fried leafy vegetables; legumes; legumes with oily seeds; fruits; natural juices and fruit milk shakes.

Mixed preparations were not considered, only the basic ingredient of each preparation. A total of seven categories of frequency of consumption were adopted (S) and a weighted value based on annual consumption was attributed to each of them, in an increasing order, according to the frequency (S1=0; S2=0.03; S3=0.08; S4=0.22; S5=0.50; S6=0.79; S7=1), where the minimum value corresponds to foods not consumed, while the maximum corresponds to daily consumption. The scores of consumption 1 and 2 were obtained from the sum of values corresponding to each of the foods, according to their category.

The score per se is a value that does not require a unit of measurement. In the study conducted by Fornés<sup>14</sup>, quintiles of food scores were considered to establish an association between serum lipid levels and diet, which is a way to validate the questionnaire to identify potentially atherogenic dietary patterns. In the present study, pure scores were used (adapted from the original research project), simply aiming to characterize the dietary pattern of a group of interest.

The short version of the International Physical Activity Questionnaire, 8<sup>th</sup> version (IPAQ-8), validated for the Brazilian population, was used to evaluate the current physical activity level. This instrument estimates the time spent on physical activities associated with lifestyle (leisure time, work, transportation and household activities) and enables the classification of individuals into physically inactive, insufficiently active, active and very active, in terms of activities performed in a continuous period of at least ten minutes per day, during the last week<sup>24</sup>. To obtain this classification, the frequency and duration of different types of activities are added (walking + moderate + vigorous)<sup>24</sup>. The categories used are described as follows:

- \* Inactive: Does not perform any physical activity for at least ten continuous minutes during the week;
- \* Insufficiently active: Performs physical activity for at least ten minutes per week, although this is considered insufficient

to classify them as active, as it does not meet the recommendations of frequency and duration of physical activity;

- \* Active: Performs vigorous physical activity three days a week or more, during 20 minutes or more per session; or at least 150 minutes of moderate physical activity per week; or walking five times a week or more.
- \* Very active: Performs vigorous physical activity five days a week or more, for at least 30 minutes per session; or performs vigorous physical activities at least three days a week, in sessions of 20 minutes or more, in addition to moderate activities and/or walks five days a week or more, for 30 minutes per session or more.

### Statistical analysis

Variables were summarized and represented by relevant descriptive statistics: absolute (n) and relative frequencies (%) or mean and standard deviation (sd). The presence of an association between the categorized variables was evaluated by Pearson's chi-square test or verisimilitude ratio. Groups of interest were compared in terms of the means of quantitative variables, using Student's t-test for independent samples. Paired t-test was applied to compare food scores. In all analyses, a 0.05 significance level was adopted ( $\alpha = 5\%$ ) and the SPSS statistical package, version 15.0 for Windows, was used.

### Results

The sample was comprised of 314 adults (192 men and 122 women), during a period of 18 months, between December 2004 and May 2006. Although the original study had included elderly individuals (aged more than 65 years), the present study excluded such individuals (n = 5), due to their small number, to enable a better analysis and data discussion. The group undergoing HAART included 238 individuals and the group not undergoing it included 76. Data were missing in 28 cases (group undergoing HAART)

and seven cases (group not undergoing HAART) in laboratory tests. Mean age of patients (sd) was 40.7 (7.6) years in the group undergoing HAART and 34.8 (8.1) years in the group not undergoing HAART.

Clinical characteristics of infection, HAART data and risk factors for the development of CVD are described in Table 1. Statistically significant differences were found for age, time of HIV infection, CD4+ T lymphocyte count and viral load. The prevalence of excessive weight surpassed that of malnourishment in both groups. There was no significant difference among the prevalences of metabolic syndrome, systemic arterial hypertension (SAH) and risk factors for the development of CVD between the two groups.

With regards to biochemical characteristics, means of serum levels of total cholesterol, HDL-cholesterol, triglycerides, apolipoprotein A and glycemia were statistically significant between the groups ( $p < 0.001$ ), unlike the levels of LDL-cholesterol and apolipoprotein B, as shown in Table 2. According to the literature, patients undergoing HAART are expected to have higher levels of total cholesterol and triglycerides<sup>4</sup>. Nothing can be inferred from the LDL-cholesterol and HDL-cholesterol levels observed, because the sample was not controlled for antiretroviral class. Types of highly active antiretroviral therapy were grouped according to their highest frequency in the sample to describe lipid levels, aiming to facilitate the analysis in

**Table 1** - Sample characterization of individuals living with HIV/AIDS in STD/AIDS specialized outpatient care in Sao Paulo, Brazil, from December 2004 to May 2006.

Clinical and nutritional characteristics	%		p
	Group undergoing HAART n = 238	Group not undergoing HAART n = 76	
Age (years)*	40.5 (7.6)*	34.8 (8.1)*	< 0.001
Time of HIV infection (years)*	5.7 (4.2)*	2.8 (3.5)*	< 0.001
Time of HAART (years)*	4.4 (3.5)*	---	---
CD4+ T lymphocytes (cells/mm <sup>3</sup> )*	475.1 (283.4)	587.2 (342.8)	0.005
Viral load (log)*	2.82 (0.63)	4.27 (0.90)	< 0.001
Sex			0.340
Male	59.7	65.8	
Female	40.3	34.2	
Nutritional status			0.386
Malnourishment <sup>a</sup>	6.3	2.7	
Excessive weight <sup>b</sup>	37.8	38.7	
Metabolic syndrome <sup>c</sup>	12.9	11.6	0.783
Systemic arterial hypertension <sup>d</sup>	19.0	13.3	0.259
Family history of cardiovascular disease	41.9	36.0	0.361
Smoking <sup>e</sup>	25.6	30.3	0.427
Physical inactivity <sup>f</sup>	30.9	30.3	0.962

\* Values shown are means (standard deviation).

<sup>a</sup> BMI < 18.5 kg/m<sup>2</sup><sup>23</sup>

<sup>b</sup> BMI ≥ 2.0 kg/m<sup>2</sup><sup>23</sup>

<sup>c</sup> According to criterion from the National Cholesterol Education Program's Adult Treatment Panel III (NCEP-ATP III)<sup>26</sup>

<sup>d</sup> According to the *IV Diretrizes Brasileiras sobre Dislipidemia e Prevenção da Aterosclerose* (4<sup>th</sup> Brazilian Directives on Dyslipidemia and Prevention of Atherosclerosis)<sup>27</sup>

<sup>e</sup> Regular or occasional consumption of any smoking products

<sup>f</sup> Inactive or insufficiently active individuals<sup>25</sup>

five groups – groups A (80 patients), B (14 patients), C (14 patients), D (27 patients) and E (19 patients) – as described in the methodology. In this analysis, there were no differences in lipid profile among these five groups.

As regards anthropometric measures, mean BMI was 24.4 (4.3) kg/m<sup>2</sup> in the group undergoing HAART and 24.3 (3.5) kg/m<sup>2</sup> in the group not undergoing HAART, both corresponding to the state of eutrophia. Abdominal and waist circumference levels in both sexes were not different between groups. However, the waist-hip ratio was statistically more significant in men undergoing HAART than in those not undergoing it (0.90±0.06 against 0.87±0.05). Arm Muscle Circumference (AMC) was higher in individuals not undergoing HAART (p = 0.004). AMC was significantly lower in

men undergoing HAART than those not undergoing it (p= 0.004). In a study using electric bioimpedance (EB) in individuals living with HIV/AIDS and undergoing HAART, there was a loss of lean mass in the first stages of infection<sup>25</sup>. These authors recommend monitoring of loss of lean mass in individuals living with HIV/AIDS, considering its association with the increase in complications and risk of mortality in this population. Physical activity practice must also be promoted, aiming to increase lean mass.

With regard to the WHR in the present study, men undergoing HAART showed a higher WHR value than those not undergoing it (p < 0.001). An American study, conducted in 1999, compared WHR measurements in individuals living with HIV/AIDS and cared for in a clinic of the state

**Table 2** - Biochemical and anthropometric characteristics of individuals living with HIV/AIDS, in STD/AIDS specialized ambulatory care in Sao Paulo, Brazil, from December 2004 to May 2006.

Biochemical and anthropometric variables	Mean (sd)		p
	Group undergoing HAART n = 238	Group not undergoing HAART n = 76	
Total cholesterol (mg/dL)	204.1 (44.6)	180.5 (39.5)	< 0.001
LDL – cholesterol (mg/dL)	115.2 (36.7)	107.3 (33.3)	0.123
HDL – cholesterol (mg/dL)	50.9 (14.2)	43.4 (12.2)	< 0.001
Triglycerides (mg/dL)	219.4 (162.4)	164.5 (125.1)	0.004
Apolipoprotein A (mg/dL)	130.0 (27.5)	113.4 (29.3)	< 0.001
Apolipoprotein B (mg/dL)	86.9 (26.5)	79.8 (26.5)	0.061
Glycemia (mg/dL)	101.1 (18.6)	92.7 (9.9)	< 0.001
Body mass index (kg/m <sup>2</sup> )	24.4 (4.3)	24.3 (3.5)	0.845
Waist circumference (cm)			
Men	87.7 (9.1)	84.9 (8.9)	0.063
Women	84.3 (12.0)	80.7 (9.6)	0.167
Hip circumference (cm)			
Men	97.0 (7.4)	97.9 (7.5)	0.440
Women	97.6 (10.5)	96.3 (6.8)	0.569
Waist-hip ratio			
Men	0.90 (0.06)	0.87 (0.05)	< 0.001
Women	0.86 (0.07)	0.84 (0.07)	0.097
Triceps skin fold (mm)			
Men	13.1 (6.9)	13.4 (7.5)	0.780
Women	19.4 (8.7)	18.9 (6.0)	0.787
Arm muscle circumference			
Men	25.0 (4.6)	26.8 (3.5)	0.004
Women	22.5 (3.7)	22.3 (3.9)	0.726

**Table 3** - Food consumption pattern scores related to cardiovascular diseases among groups of individuals living with HIV/AIDS in STD/AIDS specialized ambulatory care in Sao Paulo, Brazil, from December 2004 to May 2006.

Group	Score I ("not protective" foods)	Score II ("protective" foods)	p
Undergoing HAART (n=248)	7.5	6.8	0.001
Not undergoing HAART (n=76)	7.8	6.9	< 0.001
Total number of patients (n=314)	7.6	6.8	< 0.001

of Massachusetts with those of a control group, not infected with HIV, and found a significant increase in its value in patients infected with HIV ( $p = 0.0001$ )<sup>26</sup>.

In the evaluation of food consumption, shown in Table 3, statistically significant differences were found between food scores 1 ("not protective") and 2 ("protective") in all analyses ( $p < 0.05$ ). In the total sample, the mean difference between scores was 0.7 ( $\pm 2.3$ ), indicating that the value of score 1 is, on average, higher than that of score 2. In the group of patients undergoing HAART, the mean difference between scores was 0.7 ( $\pm 2.4$ ), also revealing a predominance of mean values of score 1 in this group.

## Discussion

It is important to emphasize that sources of errors were minimized by training all health professionals involved with data collection, standardization and calibration of anthropometric equipment and centralization of the laboratory analysis of biochemical tests, in addition to follow-up conducted through meetings with the research coordinating office during its development.

Data from this study show that patients undergoing HAART have a longer time of infection than those who have not used drugs yet ( $5.7 \times 2.8$  years,  $p < 0.001$ ). This is expected, because the longer the time of HIV infection, the greater the chance of an individual developing AIDS and needing this type of treatment<sup>25</sup>. With regard to the CD4+ T lymphocyte count, the group not undergoing HAART showed higher values than the group undergoing it ( $475 \times 587$  cells/mm<sup>3</sup>), which is also expected, once one of the indications to begin this type of

treatment is a CD4+ T lymphocyte count between 200 and 350 cells/mm<sup>3</sup>, as this indicates a decrease in the immune system<sup>27</sup>. With regard to the viral load, the lowest values were found in patients undergoing HAART. This fact reflects good adherence and good virological control of the disease in individuals undergoing treatment, which is in agreement with the literature<sup>28</sup>. Studies indicate that, after the introduction of HAART, 80% of individuals reach an undetectable viral load, even with a mean adherence rate of only 50%<sup>28</sup>.

In terms of the occurrence of dyslipidemia, the results of the present study reveal that 37.7% of patients undergoing HAART have hypertriglyceridemia and 18% have hypercholesterolemia, data that are similar to those in the literature<sup>6,11,29,30</sup>. Up until now, there have been few studies that assess apolipoproteins A and B in the HIV-infected population. Apo A represents the HDL-c fraction and Apo B represents the LDL-c fraction<sup>31</sup>. In the present study, Apo B values were found to be within normal levels in more than 80% of patients in both groups, while Apo A values were also within normal levels in 70% and 45.5% in the groups undergoing and not undergoing HAART, respectively<sup>31</sup>. Currently, due to their high cost, doses of apolipoproteins A and B are only used in research. By comparing the lipid profile between groups, higher lipid levels were found in the group undergoing HAART (TC, triglycerides, HDL-c) and the difference between means was not statistically significant in the LDL-c variable exclusively ( $p = 0.123$ ). These data corroborate other studies<sup>32-34</sup> that point out that lipid abnormalities become more evident among those infected with HIV after the introduction of

HAART and that hypercholesterolemia and hypertriglyceridemia are the most relevant disorders. By comparing these data to those of the Brazilian population aged more than 18 years and not infected with HIV, a low incidence of total cholesterol higher than 200 mg/dL is observed (18% against 40%)<sup>35</sup>.

The analysis of the type of highly active antiretroviral therapy responsible for the highest levels of hyperlipidemia was not an object of this study, due to the small sample size and strictness of inclusion criteria.

With regard to the risk factors associated with development of CVD, it was observed that the mean age is 39.5 years, 26.6% of patients are smokers, 18.3% are hypertensive and 39.9% had a family history of atherosclerosis. Furthermore, 88% of patients had at least one risk factor for the development of CVD. These data are higher than those found in the Brazilian population in general, where 70% of this population have one of more risk factors for CVD, such as diabetes mellitus, smoking, family history or arterial hypertension<sup>35</sup>. In the study conducted by Friis-Moller *et al.*<sup>29</sup>, the risk factors most frequently associated with development of CVD in the HIV-infected population were age and smoking. In the Swiss cohort study, 57% of individuals were smokers, 37.2% had low HDL-c levels, 35.7% had hypertriglyceridemia, and 26.1% were hypertensive<sup>36</sup>. The present study showed a population that is relatively young to develop CVD. The remaining risk factors were in accordance with the literature: smoking in 26.6% of cases, arterial hypertension in 18.3%, hypertriglyceridemia in 37.7% and low HDL-c levels in 26%. In the studies conducted by Currier<sup>37</sup> and Carr<sup>38</sup>, approximately 60% of HIV-infected patients had hyperglycemia, hyperlipidemia and central obesity, whereas 88.3% of patients had such conditions in the present study. According to the data shown in this study and compared to the literature and national data, which show a prevalence of smoking in individuals aged over 25 years varying from 19.1% to 24.8%, it is concluded that this is the most predominant risk factor found in the HIV-infected population,

which should be intensely fought against as this is a modifiable risk factor for CVD<sup>37</sup>.

A high and similar proportion of physical inactivity was found between groups, a factor associated with lifestyle that deteriorates cardiovascular health. Epidemiological evidence points to the benefits of physical activity practice in routine actions, characterized by an active lifestyle that prevents abdominal fat storage in individuals living with HIV/AIDS<sup>8</sup>.

A significant increase in the prevalence of metabolic syndrome in HIV-infected individuals undergoing HAART, compared to the normal population, has been described<sup>40,41</sup>. In the present study, metabolic syndrome was observed in 12.9% and 11.6% of patients in the group undergoing HAART and that not undergoing it, respectively, with a difference that was not statistically significant ( $p = 0.783$ ). Data from the present study are different from those described by Estrada *et al.*<sup>42</sup>, in which 146 individuals were evaluated and metabolic syndrome was present in 15.8% of those in the group undergoing HAART and in 3.2% of those in the control group, not infected with HIV. Jerico *et al.*<sup>43</sup> found 17% of metabolic syndrome in 710 individuals living with HIV/AIDS, a proportion similar to that observed in this study.

Weighing the benefits of HAART to improve the clinical prognosis of HIV infection against its adverse effects that predispose a higher risk of CVD is something that should be performed by professionals involved with the treatment of individuals living with HIV/AIDS. Although this type of HAART was not an epidemiological factor in the present study, the importance of such analysis to promote the clinical practice and early multidisciplinary intervention, aiming to prevent possible undesirable clinical events, should be emphasized.

The change in paradigm of the nutritional status of individuals living with HIV/AIDS, already achieved in the literature,<sup>3,5,9</sup> is corroborated in the present study. Low prevalences of malnourishment were found; in contrast, prevalences of excessive weight of 38% were found in both groups. Jaime

et al. 2004 observed similar prevalences of excessive weight (36.5%) in HIV-infected women undergoing HAART, in the city of São Paulo<sup>9</sup>.

With regard to the diet, both groups showed a higher and significant mean of score 1, i.e. greater consumption of foods “not protective” against the occurrence of CVD, sources of cholesterol, saturated and trans fat, sodium and simple carbohydrates. A case-control study revealed a high consumption of total fats and a higher percentage of energy intake coming from saturated fats and their association with hypertriglyceridemia in HIV-infected North-American individuals with metabolic abnormalities<sup>11</sup>. The dietary pattern based on fast food consumption was correlated to lower fiber intake and low CD4+ T lymphocyte count, in addition to contributing to an increase in the BMI in HIV-infected individuals<sup>12</sup>. Observational studies with individuals living with HIV/AIDS and undergoing HAART<sup>4,15,18</sup> also identified an inadequate dietary pattern, corroborating the results shown and clarifying the need to improve dietary practices to achieve adequacy of nutritional requirements and the resulting health promotion and prevention of diseases in this population group<sup>10</sup>.

The cross-sectional and descriptive nature of this study does not enable the establishment of cause and effect relationships between the dietary pattern and the clinical and nutritional status of individuals living with HIV/AIDS; however, it offers the distribution of the main events associated

with the occurrence of CVD between the groups of interest. Thus, it provides important elements to formulate hypotheses on life habits, particularly diet and physical activity, and on other clinical and metabolic factors of individuals living with HIV/AIDS, providing the basis for future studies with a more advanced design, supported by analytical epidemiology.

Findings of this study enable a clinical and nutritional perspective of individuals living with HIV/AIDS, which is clarified by risk factors for the occurrence of CVD. Thus, they can contribute to direct the focus and profile of STD/AIDS specialized services, in addition to nutritional care to control factors associated with this disease.

Authors of this study affirmed there were no conflicts of interest.

## Acknowledgements

Authors would like to thank the Brazilian Ministry of Health, UNESCO, the City of São Paulo Department of Health and the *Instituto de Doenças Infecciosas e Parasitárias* (IDIPA – Institute of Infectious and Parasitic Diseases) of the UNIFESP (São Paulo Federal University) for their support for this research; Profª Nêlida Fornès, Denise S.M. Oskata, Edina Aparecida T. Trovões, Elenice M Morales Campos, Helga Fuchs Piloto, Janice Chencinski, Iara Lobo Macedo, Marisia Nagamini, Marta C. Pereira and Nivania F. Zauith for their invaluable help in data collection and evaluation.

---

## References

1. SMS – Secretaria Municipal de Saúde de São Paulo. Programa Municipal de DST/AIDS. Boletim Epidemiológico de Aids, HIV/DST e Hepatites B e C do Município de São Paulo; 2008, Ano XII. Nº 11.
2. Palella FJ, Delaney KM, Moorman AC, Loveless MO., Fuhrer J, Satten GA et al. Declining Morbidity and Mortality among Patients with Advanced Human Immunodeficiency Virus Infection. *N Engl J Med* 1998; 338: 853-60.
3. Morse CG, Kovacs JA. Metabolic and Skeletal Complications of HIV Infection - The Price of Success. *JAMA* 2006; 296(7): 844-54.
4. Oh J, Hegele RA. HIV-associated dyslipidaemia: pathogenesis and treatment. *Lancet Infect Dis* 2007; 7: 787-96.
5. Crum-Cianflone N, Tejedor R, Medina S, Barahona I. Obesity among patients with HIV: the latest epidemic. *AIDS Patient Care STDs* 2008; 22(12): 925-30.

6. Currier JS, Lundgren JD, Carr A, Klein D, Sabin CA, Sax PE, et al. Epidemiological Evidence for Cardiovascular Disease in HIV-Infected Patients and Relationship to Highly Active Antiretroviral Therapy. *Circulation* 2008; 118(18): e29-e35.
7. WHO – World Health Organization. *Diet, Nutrition and the Prevention of Chronic Diseases*. Report of a joint WHO/FAO Consultation. Technical Report Series no. 916. Geneva; 2003.
8. Florindo AA, Latorre MRDO, Jaime PC, Segurado AAC. Leisure time physical activity prevents accumulation of central fat in HIV/AIDS subjects on highly active antiretroviral therapy International Journal of STD & AIDS.2007;18:692–96.
9. Jaime PC, Florindo AA, Latorre MRDO, Brasil BG, Santos ECM, Segurado AAC. Prevalência de sobrepeso e obesidade abdominal em indivíduos portadores de HIV/AIDS, em uso de terapia antiretroviral de alta potência. *Rev bras epidemiol.* 2004; 7(1):65-72.
10. WHO – World Health Organization. Report of a Technical Consultation. Nutrient Requirements for People Living with HIV/Aids. Geneva: World Health Organization. Geneva: 2003.
11. Joy T, Keogh HM, Hadigan C, Lee H, Dolan SE, Fitch K et al. Dietary fat intake and relationship to serum lipid levels in HIV-infected patients with metabolic abnormalities in the HAART era. *Aids* 2007; 21: 1591-600.
12. Jaime PC, Florindo AA, Latorre MRDO, Segurado AAC. Central obesity and dietary intake in HIV/AIDS patients. *Rev Saúde Pública* 2006; 40(4): 634-40.
13. Hu FB. Globalization of food patterns and cardiovascular disease risk. *Circulation* 2008; 118(19): 1913-4.
14. Fornés NS, Martins IS, Velásquez-Meléndez G, Latorre M do RD de O. Escores de consumo alimentar e níveis lipêmicos em população de São Paulo, Brasil. *Rev Saúde Pública* 2002; 36(1): 12-8.
15. Duran ACFL, Almeida LB, Segurado AAC, Jaime PC. Diet quality of persons living with HIV/AIDS on highly active antiretroviral therapy. *J Hum Nutr Diet* 2008; 21: 346–50.
16. Novaes HMD. Pesquisa em, sobre e para os serviços de saúde: panorama internacional e questões para a pesquisa em saúde no Brasil. *Cad Saúde Pública* 2004; 20 (S2): S147-73.
17. Silva EFR, Bassichetto KC, Lewi DS. Perfil lipídico, fatores de risco cardiovascular e Síndrome Metabólica em um grupo de pacientes com aids. *Arq Bras Cardiol* 2009; 93(2): 113-8.
18. LANPOP – Laboratório de Avaliação Nutricional de Populações. *Manual de técnicas antropométricas*. São Paulo: FSP; 2006.
19. WHO – World Health Organization. *Obesity: preventing and managing the global epidemic*. Report WHO Consultation. Geneva; 2000. Technical Report Series, 894.
20. Frisancho AR. New norms of upper limb fat and muscle areas for assessment of nutritional status. *Amer J Clin Nutr* 1981; 34(11): 2540-5.
21. Reeder BA, Senthilselvan A, Després JP, Angel A, Liu L, Wang H et al. The association of cardiovascular disease risk factors with abdominal obesity in Canada. Canadian Heart Health Surveys Research Group. *CMAJ* 1997; 157 (S1): S39-45.
22. Third Report of the National Cholesterol Education Program (NCEP). Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. *Circulation* 2002; 106: 3143-421.
23. Florindo AA, Latorre MRDO, Santos ECM, Borelli A, Rocha MS, Segurado AAC. Validação de métodos de estimativa da gordura corporal em portadores do HIV/AIDS. *Rev Saúde Pública* 2004; 38(5): 243-9.
24. Matsudo S, Araújo T, Matsudo V, Andrade D, Andrade E, Oliveira C et al. Questionário Internacional de Atividade Física (IPAQ): estudo de validade e reprodutibilidade no Brasil. *Rev Bras Ativ Fís Saúde* 2001; 6(2): 5-12.
25. Roubenoff R, Grinspoon S, Skolnik PR, et al. Role of cytokines and testosterone in regulating lean body mass and resting energy expenditure in HIV-infected men. *Am J Physiol Endocrinol Metab* 2002; 283: E138-45.
26. Hadigan C, Meigs J. B, Corcoran C, Rietschel P, Piecuch S, Basgoz N et al. Metabolic abnormalities and cardiovascular disease risk factors in adults with human immunodeficiency virus infection and lipodystrophy. *Clin Infect Dis* 2001; 32: 130-9.
27. *Recomendações para terapia antirretroviral em adultos e adolescentes infectados pelo HIV*. 2008. Brasília; 2008. Disponível em <http://www.aids.gov.br/data/documents/storedDocuments>. [Acessado em 20 de outubro de 2008].
28. Colombrini MRC, Lopes MHB, Figueiredo RM. Adesão à terapia antiretroviral para HIV/AIDS. *Rev Esc Enferm USP* 2006; 40(4): 576-81.
29. Friis-Moller N, Weber R, Reiss P, Thiebaut R, Kirk O., D'Arminio Monforte A et al. For the D.A.D Study Group. Cardiovascular risk factors in HIV patients - associations with antiretroviral therapy. Results from DAD Study. *AIDS* 2003; 17: 1179-93.
30. Bozzette SA, Ake CF, Tam HK, Chang SW, Louis TA. Cardiovascular and cerebrovascular events in patients treated for human immunodeficiency virus infection. *N Engl J Med* 2003; 348, 702-10.

31. Ridker PM, Rifai N, Cook NR, Bradwin G, Buring JE. Non-HDL cholesterol, apolipoproteins A-I and B100, standard lipid measures, lipid ratios, and CRP as risk factors for cardiovascular disease in women. *JAMA* 2005; 294(3): 326-33.
32. IV Diretriz Brasileira sobre Dislipidemia e Prevenção da Aterosclerose. Departamento de Aterosclerose da Sociedade Brasileira de Cardiologia. Sposito AC, Caramelli B, Fonseca FAH, Bertolami MC. *Arquiv Bras Cardiol* 2007; 88(S1): 1-19.
33. Mulligan K, Grunfeld C, Tai VW, Algren H, Pang M, Chernoff DN et al. Hyperlipidemia and insulin resistance are induced by protease inhibitors independent of changes in body composition in patients with HIV infection. *J Acquir Immune Defic Syndr* 2000; 23: 35-43.
34. Savès M, Raffi F, Capeau J, Rozenboum W, Ragnaud JM, Perronne C et al. Factors related to lipodystrophy and metabolic alterations in patients with human immunodeficiency virus infection receiving highly active antiretroviral therapy. *Clin Infect Dis* 2002; 34: 1396-405.
35. *Dados brasileiros sobre colesterol*. Disponível em: <http://www.cardiol.br/imprensa/jornais/defaultnew2.htm>. [Acessado em 15 de janeiro de 2007].
36. Glass TR, Ungsedhapand C, Wolbers M, Weber R, Vernazza PL, Bucher HC et al. Prevalence of risk factors for cardiovascular disease in HIV-infected patients over time: the Swiss HIV Cohort Study. *HIV Med* 2006; 7(6): 404-10.
37. Currier JS, Havlir DV. Complications of HIV Disease and Antiretroviral therapy. *Top HIV Medicine* 2005; 13(2): 70-4.
38. Carr A, Samaras K, Chisholm DJ, Cooper DA. Pathogenesis of HIV-1 protease inhibitor-associated peripheral lipodystrophy, hyperlipidaemia and insulin resistance. *Lancet* 1998; 351: 1881-83.
39. Instituto Nacional do Câncer (Brasil). *Prevalência de tabagismo no Brasil. Dados dos inquéritos epidemiológicos em capitais brasileiras*. 2004 [monografia da internet]. Rio de Janeiro-RJ: INCA. Disponível em [bvsms.saude.gov.br/bvs/publicações/tabaco\\_inquerito\\_nacional\\_070504.pdf](http://bvsms.saude.gov.br/bvs/publicações/tabaco_inquerito_nacional_070504.pdf). [Acessado em 20 de janeiro de 2007].
40. Gazzaruso C, Bruno C, Garzaniti A, Giordanetti S, Fratino P, Sacchi P et al. Hypertension among HIV patients: prevalence and relationships to insulin resistance and metabolic syndrome. *J Hypertens* 2003; 21: 1377-82.
41. Bruno R, Gazzaruso C, Sacchi P, Zocchetti C, Giordanetti S, Garzaniti A, et al. High prevalence of metabolic syndrome among HIV-infected patients: link with the cardiovascular risk. *J Acquir Immune Defic Syndr* 2002; 31: 363-5.
42. Estrada V, Martinez-Larrad T, Gonzalez-Sanchez JL, de Villar NGP, Zabena C, Fernandez C et al Lipodystrophy and metabolic syndrome in HIV-infected patients treated with antiretroviral therapy. *Metabolism* 2006; 55: 940-945
43. Jerico C, Knobel H, Montero M, Ordoñez-Llanos J, Guelar A, Gimeno JL et al. Metabolic Syndrome among HIV infected patients: prevalence, characteristics and related factors. *Diabetes Care* 2005; 28: 132-37.