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DIETARY PATTERNS, OVERWEIGHT AND ABDOMINAL OBESITY IN PEOPLE LIVING WITH HIV/AIDS

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Highlights: (1) Dietary patterns were monotonous with low nutritional diversity. (2) Overweight and abdominal obesity were not associated with the identified patterns. (3) High physical activity may have attenuated the adiposity observed. (4) Strengthening nutrition education is necessary for this population.

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ABSTRACT

Objective To evaluate the association between overweight, abdominal obesity, and dietary patterns in people with HIV/AIDS using antiretroviral therapy. **Method:** Cross-sectional study with 217 HIV-positive individuals attended at a reference institute for infectious diseases in Teresina, Piauí, Northeast Brazil. Overweight was assessed by body mass index (BMI) and abdominal obesity by waist circumference (WC) and neck circumference (NC). Food consumption was investigated through a 24-hour recall and dietary patterns were identified by the Principal Component Factor Analysis (PCFA) method. The adequacy of PCFA data was verified by the Kaiser-Meyer-Olkin (KMO) test and Bartlett's sphericity test. Poisson regression analysis with robust variance was used to verify the association between variables. **Results:** Four patterns were identified of dietary patterns, which were monotonous and not very diverse: “Breakfast”, “Traditional”, “Western” and “Healthy” (KMO = 0.5157), poor in food variety. In the adjusted analysis, overweight and abdominal obesity were not associated with the different dietary patterns identified (p 0.05). **Conclusion:** It was concluded that the dietary pattern in people with HIV/AIDS is not associated with abdominal fat deposition. Food education measures should be intensified for this population, encouraging the consumption of foods rich in immunomodulatory nutrients and improving quality of life.

Keywords: Diet, Overweight, Obesity, HIV/AIDS

INTRODUCTION

Acquired Immunodeficiency Syndrome (AIDS) is a disease caused by infection with the *Human Immunodeficiency Virus* (HIV), being a broad-spectrum infectious condition, with variable clinical course, progressive suppression of the immune system, and several nutritional impacts on affected individuals[1-2]. The use of Highly *Active Antiretroviral Combination Therapy* (HAART) has been responsible for a significant reduction in AIDS mortality and increase in survival among people with HIV/AIDS since 1996, culminating in a change in the clinical profile from a lethal subacute disease to a chronic outpatient disease[3].

In this context, prolonged HAART use has been associated with a significant increase and undesirable metabolic and nutritional alterations, which, together with exposure to the modern obesogenic environment and unhealthy eating, facilitates the onset of metabolic diseases in people with HIV[4]. Studies have shown that HAART promotes weight gain and redistribution of body fat, favoring obesity and excessive fat accumulation in the abdominal, trunk and neck regions[5] and characterized the lipodystrophy condition, very common in people with HIV undergoing treatment. Also, the prevalence of nutrition-related undernutrition to HIV decreased with the introduction of HAART, while observed increasing proportions of overweight and obesity in those infected[6].

Notwithstanding the changes in body composition related to HAART have been extensively investigated in the clinical context of HIV, the role of diet has received less attention, making the outlining of research on dietary patterns in people with HIV. The association of energy and/or nutrient intake, in isolation, with the outcomes nutritional outcomes related to the disease may be difficult to interpret, since nutrients do not are consumed nor act in isolation, but are consumed together, characterizing diverse dietary patterns[7-8].

Dietary patterns are understood to reflect individuals' eating habits, taking into account the interrelationships among different foods and providing information that may indicate associations between food groups and diseases. Therefore, evaluating the effect of overall food consumption on the nutritional and clinical status of people living with

HIV, through the identification of dietary patterns, represents a promising approach to better understand the role of nutrition in the metabolic and nutritional changes observed in this population[9].

From this perspective, the present study aimed to identify dietary patterns among people living with HIV/AIDS and to evaluate their association with overweight and abdominal obesity.

MATERIALS AND METHODS

Study Design and Sample

This study used data from the larger study entitled "Effect of Vitamin D_3 Supplementation on Viral Load and Recovery of CD4+ T Cells in People Living with HIV Undergoing Antiretroviral Therapy Assisted by the Brazilian Unified Health System (SUS)," conducted between 2018 and 2019. The original study aimed to evaluate the relationship between serum vitamin D concentrations, viral load, and CD4+ T-cell counts in people living with HIV/AIDS receiving antiretroviral therapy.

The present analysis, derived from the larger study, employed a quantitative cross-sectional design and included a non-probability sample of 217 seropositive individuals receiving care at the Natan Portela Institute of Tropical Diseases (IDTNP), a specialized HIV/AIDS referral center located in downtown Teresina, Piauí, Brazil. Eligible participants were individuals aged 20 years or older, with at least 8 hours of fasting, not using vitamin supplements, without self-reported metabolic or chronic diseases, and women who were neither pregnant nor breastfeeding.

Ethical Aspects

The study was conducted in accordance with Brazilian ethical guidelines for research involving human subjects and was approved by the Research Ethics Committee of the Federal University of Piauí (CEP/UFPI) under Opinion No. 2,100,110. Written informed consent was obtained from all participants through the signing of the Informed Consent Form (ICF).

Data Collection

Data were collected between February 2018 and December 2019 by nutritionists from the Federal University of Piauí (UFPI) who were members of the research group involved in the original study. Sociodemographic and clinical variables were obtained using a printed questionnaire administered through face-to-face interviews.

Demographic and socioeconomic information

The data were obtained by trained researchers, ensuring rigor and uniformity in the data collection procedures at the IDTNP outpatient clinic during participant visits, using a questionnaire specifically developed for the study, including demographic and socioeconomic information: skin color self-reported (considering classifications of the Brazilian Institute of Geography and Statistics - IBGE), education (considering primary and secondary education levels), marital status, income per capita (socioeconomic classification according to IBGE), use of tobacco and alcoholic beverages.

Clinical Information

Regarding clinical aspects, individuals were asked about time since diagnosis of the disease, duration of HAART use, and the therapeutic regimen. Blood analysis was performed to identify disease stage, CD4+ cell levels TCD4+ and viral load. The Therapeutic Schedule (ET) was also investigated, referring to drug associations including

combinations of medications in use, consisting of three types of drugs: two NRTIs (Nucleoside Reverse Transcriptase Inhibitors) /NRTI (Nucleoside Reverse Transcriptase Inhibitor) associated with another class of antiretrovirals (NNRTIs (Non-Nucleoside Reverse Transcriptase Inhibitors), PI/r (Protease Inhibitor with Ritonavir) or INSTI (Integrase Inhibitors) [10].

Blood collection for determination of viral load and CD4+ was performed following scheduling for the tests at the IDTNP itself, in the hospital collection room, using plastic syringes and stainless steel, sterile and disposable needles. The volume of 12 ml of venous blood was drawn by a trained professional, with patients fasting for, at least eight hours. The collected material was transferred to EDTA tubes for viral load quantification (6 ml of blood) and for CD4+ lymphocyte counting (6 ml of blood). Subsequently, it was transported refrigerated to the Central Public Health Laboratory of Piauí (LACEN-PI). Viral load quantification was performed in plasma, via reaction in polymerase chain reaction (PCR, Polymerase chain reaction)) in real time, following the standard operating procedure recommended by the Ministry of Health[11]. The count of CD4+ T lymphocytes was performed by flow cytometry, following the standard operating procedure recommended by the Ministry of Health [11] .

Information on activity habits

Data were collected through the application of the Questionnaire of Habitual Physical Activity - BQHPA4, valid for assessing habitual physical activity in people with HIV/AIDS and already used in epidemiological studies in Brazil. The questionnaire is easily applied by using qualitative techniques and quantitative scales, which is structured in 16 questions and covers three components of physical activity: 1) occupational physical activities (Q1 to Q8); 2) exercises performed during leisure time (Q9 to Q12); and 3) physical activities during leisure time and locomotor activities, excluding physical exercises (Q13 to Q16) [12].

Responses were coded on a *Likert* scale, a psychomet, ric tool used in quantitative research to measure the degree of agreement or disagreement of a person with a

statement. The Likert scale adopts an ordinal scale that measures levels of agreement and disagreement of fixed-choice responses, being used to measure attitudes or opinions. Such items presented in mutually exclusive form address a specific dimension of the phenomenon under investigation to measure it[13]. The scores of all items are based on the assumption that attitudes can be measured on five points, except for occupation at school (Question 1) and the information related to sport practice and participation in physical exercise programs (Questions 9 to 9.6)[13] .

Scores corresponding to each section were calculated according to procedures previously described, so that these values resulted in a sum of scores. Then the obtained scores were distributed into percentiles, numbers that denote the position of a data point within a set of numerical data, indicating the percentage of the data set with a lower value, with individuals classified as inactive (p25, score up to 7.0); active (p50, with a score from 7.1 to 8.7) and very active (p75, score from 8.8 to 12.3).

Anthropometric information

Weight (W), height (H), waist circumference (WC) and neck circumference (NC) measurements were collected. For classification and categorization of participants' nutritional status, the Body Mass Index (BMI) was used, considering individuals with BMI up to 24.9 kg/m² as "not overweight" and those with BMI > 25 kg/m² as "overweight"[14] .

To measure weight, a Secca® anthropometric scale, model 803, with a capacity of 150 kg and precision of 100 g, was used. During the procedure, the participant was instructed to stand barefoot in the center of the scale, and this measurement was recorded in kilograms (Kg).

Height was measured using a Secca® stadiometer, with a 2.20 m ruler and 1.0 cm precision, with the patient positioned on the stadiometer platform, barefoot, heels close together, back straight and arms extended along the body, head upright, free of adornments, eyes forward (horizon line forming 90° with the ground).

The measurements of WC and NC were collected using a Secca® elastic tape, with a capacity of 1.5 m and precision of 0.1 cm. WC was measured at the midpoint between the lower rib and the iliac crest, according to WHO (1997) [15] . NC was measured at the mid-neck height with the patient seated, the tape passed around the neck, placed exactly at the center. Abdominal obesity was defined for men as WC > 94 cm or NC > 39 cm, and for women as WC > 80 cm or NC > 35 cm[14].

Dietary intake and pattern

A 24-hour dietary recall (R24h) was used using the *Multiple Pass Method – MPM* to obtain data on food intake[16]. Participants reported foods and beverages consumed the day before, preparation, brand, portions and household measures. The data were entered and processed in *Virtual Nutri Plus software* version 1.0. The *software* facilitates entering foods already registered in a database, and includes wide range of information on Brazilian foods and preparations, as well as their nutritional information. In the absence of data on some foods in the software database, they were added, based on food composition tables [17-18-19]. The inform Ation present on the labels of processed foods were used when they were not in the cited tables [20]. In order to control intrapersonal variability of the diet there was an initial application of R24h to all study participants and replication with 40% of the studied population, randomly selected.

The principal components factorial analysis method was used to identify the eating patterns. The habitual consumption of foods was estimated using the *Multiple Source Method (MSM)*[21]) which adjusts dietary data for intrapersonal variability, considering the grouping of them. The adequacy of the factorial analysis data was verified by the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity [22] .

The patterns to be retained were chosen using the eigenvalue criterion (values above 1.0), the scree plot and the interpretability of the patterns. A Varimax orthogonal rotation was performed to facilitate the interpretation of the findings. Orthogonal varimax

to facilitate interpretation of the findings. Factor loadings above 0.30 were considered to name the patterns found[22]. The naming of the patterns was given based on interpretability and the characteristics of the items retained in each pattern.

Statistical analysis

For descriptive analysis simple frequencies, measures of central tendency and dispersion. To assess the adherence of variables to the normal distribution, the Kolmogorov-Smirnov test was used. Kolmogorov-Smirnov. Differences between proportions were tested using the Pearson chi-squared test. Pearson chi-square test. The association between dietary patterns and overweight and abdominal obesity was estimated using Poisson regression with robust variance and adjustment for variables: sex, smoker, income, level of physical activity, time on HAART and overweight (BMI, except when the outcome was overweight itself), taking into consideration the p-values < 0.005 in univariate analysis. Income was included as a considered an important aspect for dietary intake and widely used in studies epidemiological. Statistical analyses were performed with the aid of *Stata* software version14. In all analyses, a significance level of 5% ($p<0.05$) and a 95% confidence interval (CI95%).

RESULTS

This study evaluated 217 people living with HIV/AIDS undergoing highly active antiretroviral therapy (HAART), who were followed at a referral hospital for infectious diseases in Teresina, Piauí, Brazil. The data presented in Table 1 characterize the sociodemographic and clinical profile of the study population, comprising 217 participants (128 men and 89 women), aged between 20 and 59 years (mean age ± standard deviation [SD]: 37 ± 0.88 years among men and 40 ± 0.96 years among women).

A higher proportion of participants were single (71.90%), self-identified as non-White (Black, Brown, or other ethnic groups) (76.90%), non-smokers (83.87%), and non-

alcohol consumers (56.60%). Most participants had more than 9 years of formal education (59.81%).

The mean monthly per capita income (SD) was R$683.26 (equivalent to US$140.88/month), with a predominance of individuals classified as Class E ("low-income class"), according to the classification criteria established by the Brazilian Institute of Geography and Statistics (IBGE, 2021).

Clinically, 64.25% of participants reported a disease duration longer than 36 months, 47.47% were in the early stage of infection, and 59.91% had an undetectable viral load. Furthermore, 59.61% of the individuals had initiated antiretroviral treatment more than 36 months prior to the study. Several antiretroviral therapy regimens were identified, with the most commonly used regimen being "TDF/3TC/EFV" (29.96%), consisting of the combination of tenofovir, lamivudine, and efavirenz.

Regarding physical activity practice and sedentary behavior, 49.31% of the participants were classified as very physically active.

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TABLE 1- Distribution of people with HIV/AIDS according to demographic, socioeconomic, and clinical variables and presence of abdominal obesity and overweight. Teresina, Northeast Brazil, 2023 (n=217).

VARIABLES	N (%)	ABDOMINAL OBESITY (WC)			ABDOMINAL OBESITY (CP)			EXCESS WEIGHT (BMI)		
		NO N (%)	YES N (%)	p-value	NO N (%)	YES N (%)	p-value	NO N (%)	YES N (%)	p-value
Gender										
Male	128 (58,99)	93 (69,40)	35 (42,17)	**0,000**	84 (54,90)	44 (68,75)	0,059	74 (58,27)	54 (60,0)	0,798
Female	89 (41,01)	41 (30,60)	48 (57,83)		69 (45,10)	20 (31,25)		53 (41.73)	36 (41,01)	
Age group (years)										
≥20 e <39	118 (54,38)	76 (56,72)	42 (50,60)	0,380	84 (54,90)	34 (53,13)	0,811	68 (53,54)	50 (55,56)	0,769
≥40 e ≤59	99 (45,62)	58 (43,28)	41 (49,40)		69 (45,10)	30 (46,88)		59 (46,46)	40 (44,44)	
Education										
≤ 9 years	87 (40,09)	47 (35,07)	40 (48,19)	0,055	64 (41,83)	23 (35,94)	0,419	46 (36,22)	41 (45,56)	0,167
>9 years	130 (59,81)	87 (64,98)	43 (51,81)		89 (58,17)	41 (64,06)		81 (63,78)	49 (54,44)	
Skin color										
White	50 (23,04)	30 (22,39)	20 (24,10)	0,771	36 (23,53)	14 (21,88)	0,792	28 (22,05)	22 (24,44)	0,913
Others	167 (76,96)	104 (77,61)	63 (75,90)		117 (76,47)	50 (78,13)		99 (77,96)	68 (75,56)	
Economy class										
Class D (low average)	79 (36,41)	95 (70,90)	50 (60,24)	0,105	97 (63,40)	48 (75,00)	0,098	85 (66,93)	60 (66,67)	0,968
Class E (low)	138 (63,59)	39 (29,10)	33 (39,76)		56 (36,60)	16 (25,00)		42 (33,07)	30 (33,33)	
Smoker										
No	182 (83,87)	107 (79,85)	27 (20,15)	**0,041**	128 (83,66)	25 (16,34)	0,896	101 (79,53)	26 (20,47)	**0,039**
Yes	35 (16,13)	75 (90,36)	8 (9,64)		54 (84,39)	10 (15,63)		81 (90,00)	9 (10,00)	

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VARIABLES	N (%)	ABDOMINAL OBESITY (WC)			ABDOMINAL OBESITY (CP)			EXCESS WEIGHT (BMI)		
		NO N (%)	YES N (%)	p-value	NO N (%)	YES N (%)	p-value	NO N (%)	YES N (%)	p-value
Use of alcohol										
No	35 (16,13)	27 (20,15)	8 (9,64)	0,405	25 (16,34)	10 (15,63)	0,325	26 (20,47)	9 (10,00)	0,581
yes	94 (43,32)	61 (45,52)	33 (39,76)		63 (41,18)	31 (48,44)		57 (44,88)	37 (41,11)	
Time of illness (TD)										
≤36 months	74 (35,75	53 (41,41)	21 (26,58)	**0,031**	55 (37,67)	19 (31,15)	0,372	46 (37,70)	28 (32,94)	
>36 months	133 (64,25)	75 (59,29)	58 (73,42)		91 (62,33)	42 (68,85)		76 (62,30)	57 (67,06	
Stage of the disease										
Early (above de 500 cells/mm^3)	103 (47,47)	61 (45,52)	42 (50,60)		67 (43,79)	36 (56,26)		53 (41,73)	50 (55,56)	
Intermediate (between 200 and 500 cells/mm^3)	69 (31,80)	45 (33,58)	24 (28,92)	0,728	53 (34,64)	16 (25,00)	0,227	45 (35,43)	24 (26,67)	0,132
Late (below de 200 cells/mm^3)	45 (20,74)	28 (20,90)	17 (37,78)		33 (21,57)	12 (18,75)		29 (22,83)	16 (17,78)	
Viral load										
Undetectable	130 (59,91)	79 (58,96)	51 (61,45)		88 (57,52)	42 (65,63)		71 (55,91)	59 (65,56)	
Below the minimum threshold	33 (15,21)	22 (16,42)	11 (13,25)	0,819	27 (17,65)	6 (9,38)	0,244	22 (17,32)	11 (12,22)	0,340
Detectable	54 (24,88)	33 (24,63)	21 (25,30)		38 (24,84)	16 (25,00)		34 (26,77)	20 (22,22)	
Time of HAART										
≤ 36 months	82 (40,39)	59 (46,46)	23 (30,26)	**0,023**	61 (42,66)	21 (35,00)	0,310	51 (42,86)	31 (36,90)	0,395
> 36 months	121 (59,61)	68 (53,54)	53 (69,74)		82 (57,34)	39 (65,00)		68 (57,14)	53 (63,10)	

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VARIABLES	N (%)	ABDOMINAL OBESITY (WC)			ABDOMINAL OBESITY (CP)			EXCESS WEIGHT (BMI)		
		NO N (%)	YES N (%)	p-value	NO N (%)	YES N (%)	p-value	NO N (%)	YES N (%)	p-value
Therapeutic regimen										
DTF/3TC/EFV	65 (29,96)	42 (31,34)	23 (27,71)		46 (30,07)	19 (29,69)		41 (32,28)	21 (26,67)	
DTF/3TC/DTG	49 (22,58)	33 (24,63)	16 (19,28)	0,200	35 (22,88)	14 (21,88)	0,989	29 (22,83)	20 (22,22)	0,802
AZT/3TC/EFV	40 (18,43)	27 (20,15)	13 (15,66)		28 (18,30)	12 (18,75)		22 (17,32)	18 (20,00)	
Other therapeutic combinations	63 (20,03)	32 (23,88)	31 (37,35)		44 (28,76)	19 (29,69)		35 (27,56)	28 (31,11)	
Physical activity										
Inactive	56 (25,81)	35 (62,50)	21 (37,50)		38 (67,86)	18 (32,14)		30 (53,57)	26 (46,43)	
				0,255			0,861			0,604
Active	54 (24,88)	38 (70,37)	16 (29,63)		38 (70,37)	16 (29,63)		34 (62,96)	20 (37,04)	
Very active	107 (49,31)	61 (57.01)	46 (42,99)		77 (71,96)	30 (28,04)		63 (58,88)	44 (41,12)	

TCD4+(Lynphocytes cluster of defferentiation); HAART (Highly Active Therapy); DTF (Tenoforvir);3 TC (Lamivudine); EFV (Efavirenz; DTG (Dolutegravir); AZT(Zidovudine); mm^3 (cubic millimeter)
Source: Research data,2023.

It was found that the average weight (SD) of men and women was 72.95 kg (3.33 kg) and 59.84 kg (1.31 kg), respectively ($p = 0.009$). Regarding the average height (SD), values of 1.69 m (0.006 m) in men and 1.56 m (0.009 m) in women were observed, with a statistically significant difference ($p < 0.001$). Although weight and stature variables were statistically different between sexes, the means (SD) of Body Mass Index (BMI) did not show a significant difference between men and women [mean (SD) 24.55 kg/m² (0.35 kg/m²); 24.35 kg/m² (0.48 kg/m²), respectively; $p = 0.729$]. Regarding anthropometric diagnosis, prevalence of overweight (BMI) was observed in 41.47% of the sample and abdominal obesity with prevalences of 38.25% and 29.49%, respectively, through waist circumference - WC and neck - NC analysis (data not shown in table).

Analyzing the proportions of overweight and abdominal obesity according to the demographic, socioeconomic and clinical variables (Table 1), it was noted that the prevalence of overweight was higher in non-smokers (90.00%, $p = 0.039$). Based on WC values, a higher prevalence of abdominal obesity was identified in females (57.83%, $p < 0.001$), non-smokers (90.36%, $p = 0.041$), with TD > 36 months (73.42%, $p = 0.031$) and with HAART time > 36 months (57.34%, $p = 0.023$). Regarding NC, no differences were observed in abdominal obesity proportions when analyzing the demographic, socioeconomic or clinical variables.

Aspects of diet studied identified four (4) different dietary patterns (Table 2). The first pattern, named “breakfast,” consisted of: foods sources of complex carbohydrates, such as corn, cassava, yam, sweet potato, white potato, tapioca, corn flour and manioc flour; fruits (avocado, acerola, guava, orange, passion fruit, tamarind); butter; margarine; and beverages (plain coffee, coffee with milk and teas of all kinds).

Table 2 – Factor loadings of food groups in the patterns identified in people with HIV/AIDS. Teresina, Northeast Brazil,2023 (n=217).

Food Groups	Food and Food Items	Factor Loadings by Dietary Patterns			
		Breakfast	Traditional	West	Healthy
Rice	White rice, rice couscous, maria isabel, baião de dois, greek-style rice.	-0,07	**0,792**	-0,069	0,009
Pasta	Pasta, lasagna.	0,238	-0,133	0,201	0,288
Couscous + Roots and tubers (with tapioca)	Corn, corn couscous, canjica, popcorn, cornstarch, cornmeal, flour, manioc, pirão, sweet potatoes, tapioca.	**0,755**	0,037	**-0,315**	0,127
Legumes	Baked beans, tropeiro beans, feijoada, fava beans, oilseeds.	0,142	**0,705**	0,213	0,084
Fruits	Pineapple, acerola, banana, orange, apple, papaya, watermelon, mango, tangerine, pear and grape.	-0,193	-0,074	-0,124	**0,608**
Vegetables	Pumpkin, lettuce, eggplant, beet, onion, green onion, carrot, chayote, maxixe, cucumber, bell pepper, okra, cabbage, vegetable salad, tomato.	0,149	-0,041	0,030	**0,661**
Natural juices	Avocado, Acerola, guava, orange, passion fruit, tamarindo.	**0,322**	-0,033	-0,144	0,144
Meat (beef, chicken, fish and eggs)	Beef, poultry, and fish, preparations based on meat and eggs, offal, and seafood.	0,132	**0,350**	-0,013	**0,564**
Sausages	Processed meats, bacon, sausage, pâté, ham, sausage.	0,177	0,140	**0,480**	0,144
Butter and margarine	Butter and margarine.	**0,581**	0,064	**0,368**	0,0367
Bread, toast, and savory cookies	White and wholemeal bread, toast, sweet and savory cookies with and without filling.	0,003	0,016	**0,765**	-0,114

Food Groups	Food and Food Items	Factor Loadings by Dietary Patterns			
		Breakfast	Traditional	West	Healthy
Bread, toast, and savory cookies	White and wholemeal bread, toast, sweet and savory cookies with and without filling.	0,003	0,016	**0,765**	-0,114
Sweetened drinks	Milk drinks, concentrated juices, soft drinks, sweets.	-0,290	-0,097	**0,499**	0,206
Coffee and tea	Coffee with milk, milk cream, condensed milk, milk, yogurt, cheeses, curd, and porridge.	**0,736**	-0,012	0,185	-0,076
Sweets	Pizzas, snacks, pies.	-0,015	**-0,512**	0.186	0.2703
		VE:14,43	VE:10,98	VE:10,33	VE:9,35

Factor loadings in bold: ≥0.30 or ≤ -0.30; VE = variance explained. KMO value: 0.5157 Source: Research data, 2023

The second pattern was identified as the "traditional" one, composed of: cereals (white rice or rice mixed with legumes or with other foods); legumes; oilseeds; meats (beef, pork, poultry and fish); viscera and seafood. The group showed factorial loading negative for cakes, tarts, desserts, sweet cookies, ice cream, sugar, condensed milk, candies, chocolates etc.

The "Western" pattern showed higher factorial loadings for processed foods (calabrese, sausage, ham); butter; margarine; breads, toasts, sweet and savory cookies, with or without filling; and sweetened drinks (dairy drinks, concentrated juices, sodas) and other sweets. The "healthy" pattern was composed of: fruits, vegetables and meats.

Table 3 presents the results of the crude and adjusted analysis of the association between the proportions of overweight and abdominal obesity with dietary patterns, adjusted for sex, smoking status, economic class, level of physical activity, duration of HAART and having or not having overweight.

TABLE 3- Crude and adjusted prevalence ratios* for overweight and abdominal obesity according to dietary patterns in people with HIV/AIDS. Teresina, Northeast Brazil, 2023 (n=217)

OVERWEIGHT-BMI						
Standards	**RPbruta**	**95%CI**	**p-value**	**RPadjusted***	**95%CI**	**p-value**
Breakfast						
Minor	1					
Larger	1,11	(0,80;1,54)	0,528	1,11	(0,80;1,54)	0,499
Traditional						
Minor	1					
Larger	0,86	(0,60;1,22)	0,412	0,86	(0,60;1,23)	0,415
West						
Minor	1					
Larger	0,95	(0,68;1,34)	0,802	0,90	(0,63;1,28)	0,576
Healthy						
Minor	1					
Larger	0,95	(0,68;1,34)	0,802	0,93	(0,66;1,31)	0,692
ABDOMINAL OBESITY – WC						
Standards	**RPbruta**	**95%CI**	**p-value**	**RPadjusted***	**95%CI**	**p-value**
Breakfast						
Minor	1					
Larger	1,13	(0,80;1,61)	0,461	1,14	(0,86;1,51)	0,335
Traditional						
Minor	1					
Larger	0,81	(0,55;1,20)	0,306	1,09	(0,77;1,52)	0,609
West						
Minor	1					
Larger	0,97	(0,67;1,39)	0,874	1,15	(0,86;1,54)	0,335
Healthy						
Minor	1					
Larger	0,86	(0,59;1,26)	0,460	0,94	(0,69;1,27)	0,709
ABDOMINAL OBESITY – NC						
Standards	**RPbruta**	**95%CI**	**p-value**	**RPadjusted***	**95%CI**	**p-value**
Breakfast						
Minor	1					
Larger	1,05	(0,68;1,62)	0,809	0,95	(0,66;1,36)	0,795
Traditional						
Minor	1					
Larger	0,72	(0,45;1,17)	0,194	0,79	(0,53;1,17)	0,246
West						
Minor	1					
Larger	1,12	(0,73;1,73)	0,575	1,05	(0,73;1,51)	0,763
Healthy						
Minor	1					
Larger	0,78	(0,49;1,25)	0,317	0,80	(0,55;1,17)	0,261

* PR (Prevalence Ratio) adjusted for gender, whether or not they smoked, economic class, level of physical activity, time on HAART, and whether or not they were overweight. WC = waist circumference; NP = neck circumference; BMI = body mass index; *Statistical significance ($p < 0.05$). Poisson regression with robust variance (bivariate).
Source: Research data, 2023.

DISCUSSION

The present study revealed original results regarding the diet of people living with HIV/AIDS in northeastern Brazil, identifying four dietary patterns whose compositions, overall, indicated little variation in consumption. Characteristics similar to the traditional and common diet of the Brazilian northeastern population predominated, in line with the profile drawn in the national survey Household Budget Survey- POF'[23]. However, the study observed that high rates of overweight and abdominal obesity are not associated with the identified dietary patterns.

In the present study, examining the characteristics of each identified pattern, showed low dietary diversity, as well as no significant association with abdominal obesity or overweight in people with HIV. It is noted that the "breakfast" pattern stood out for containing less processed foods, outlining a healthier dietary profile, low in industrialized foods that presumably would protect against overweight[24].

In turn, the "traditional" pattern presented the main groups of foods common in the basic Brazilian diet[25]. The third pattern observed in this study, the "Western," was also less diverse and poor in ultra-processed foods, but concentrated processed and caloric foods, characteristic of the "Western" pattern, which generally is characterized by high saturated fat content, high sugar added and low consumption of dairy products added sugar and low consumption of dairy products[14] .

The fourth and last pattern, "healthy" included plant-origin foods, as noted in some studies[27]. The authors define the "healthy" pattern as those with diets containing low amounts of fats, simple carbohydrates and sodium, and rich in fiber and minerals, forming a dietary pattern with the potential to soften metabolic abnormalities[28].

Our results showed that in addition to the limited dietary variety, it was observed a significant contribution of foods that are sources of carbohydrates and proteins, with little contribution from vegetables, corroborating other research conducted in Brazil [29-30-31] and in other countries [6-32].

From this perspective, in Cape Verde, South Africa, a study conducted with 458people living with HIV/AIDS in a community center, identified diets poor in nutritional diversity, with starchy- and protein-based diet, and lack of vegetables and fruits

in the last 24 hours[6]. In a study conducted in Nepal[32] with 350 people with HIV/ AIDS attended in outpatient care, it was also observed that most did not have a diversified diet (62.3%). These findings are further reinforced by a review study, noting that the diet of people with HIV is considered monotonous, high in calories and with little variety of micronutrients, mainly in developing countries, highlighting the intake of simple carbohydrates, corn and legumes, meats and some fruits and vegetables[33].

In Brazil, a study conducted[34] in a reference hospital in Rio de Janeiro, involving 69 people with HIV/AIDS on HAART, showing extensive intake of rice, beans and French bread, as well as chicken consumption as the main protein source. The author also noted an unsatisfactory consumption of fruits, as well as daily consumption of vegetables, milk and dairy products. It is important to note that most research on the diet of people with HIV/ AIDS in Brazil investigated macronutrient intake, and few studies aimed to identify dietary patterns in this population.

Regarding abdominal adiposity and excess weight, the prevalence is observed and incidence of obesity in people with HIV, especially women, the group that showed the most individuals with abdominal obesity, corroborating the results found in this study[34]. Also cited is a pooled analysis of three randomized clinical trials comparing 760 women with 3,041 men starting HAART, where it was found that women had an average BMI increase of 0.59 kg/m2 greater than men.

Despite the high rates of overweight and abdominal obesity observed in the population studied, the absence of association with different dietary patterns may be justified by limited dietary diversity, in line with a study on body size and nutritional risk for obesity[35] in addition to the studied population self-identifying as highly active. A balanced diet and regular physical activity contribute to an adequate nutritional status, which, together with highly active antiretroviral therapy (HAART), slow the progression of the disease.

However, it is known that HAART can influence weight gain[2].Therefore, proper nutrition is needed for the functioning of the immune system; consequently, nutritional therapy is considered an important adjuvant in the treatment of patients with HIV[36,37]. People living with HIV/AIDS are as susceptible to overweight/obesity as non-infected

individuals and are significantly affected by the adverse effects of these health conditions [38,24]. The specific factors of HIV and antiretroviral therapy (HAART) may contribute to fat gain and fat quality in treated HIV infection, particularly for the development of visceral adiposity [9]. The influence of HAART on adiposity is not specifically the dietary pattern as the main finding, which can be explained by the fact that the association of tenofovir with lamivudine (TDF/3TC) presents a favorable toxicity profile regarding lipodystrophy and hematologic toxicity when compared with other antiretrovirals. Efavirenz (EFV), also used by the studied population, has a convenient dosage (1 tablet per day), facilitating adherence to treatment, promotes long-term viral replication suppression, but also has a favorable toxicity profile for lipodystrophy [11].

It is important to emphasize that even so, dietary quality has a direct relationship with the individual's health and nutritional guidance becomes necessary and frequent in order to avoid complications. Thus, the relationship between diet and health seems quite obvious, in which healthy eating practices relate to the quality of the diet and refer to the degree of adequacy of a dietary pattern in relation to recommendations for healthy eating[40].

We recognize that these findings should be interpreted in light of some limitations. The sample of the present study notes the lack of biochemical analyses that could verify lipid composition, as well as reinforce data on body composition and abdominal adiposity. No statistically significant associations were observed between the patterns identified dietary patterns with the anthropometric indicators evaluated, even after adjustment, suggesting that overweight and abdominal obesity were independent of the dietary patterns of the studied population.

CONCLUSION

In conclusion, the analysis of the dietary pattern, presented in the study, contributed to the understanding of the reality of dietary intake in people with HIV/AIDS. The patterns identified dietary patterns indicated a dietary composition similar to the Brazilian population in general, with a tendency toward healthier aspects. The largest proportion of the studied population is eutrophic when considering BMI, and a

smaller proportion of individuals present abdominal obesity considering WC and HC, which can be explained by the fact that most of the population is very active in relation to physical activity and in good clinical conditions in relation to AIDS, and additionally the population has more years of schooling which may lead to better dietary choices even with a lower income by taking into account the health condition. health. The study evaluates that dietary patterns do not influence or determine, alone, the body composition of people with HIV/AIDS, being more influenced by the therapy used and the duration of the illness.

Up to now there is no knowledge about the analysis of dietary patterns and overweight or obesity in the studied population, with the present study being very important to enable the proposal of actions and development of nutritional strategies in health, improving quality of life for these people.

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EATING PATTERNS, OVERWEIGHT AND ABDOMINAL OBESITY IN PEOPLE LIVING WITH HIV/AIDS

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