

Comparative Study of the Functional Capacity of the Old Person with and Without HIV

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ABSTRACT

The 20th century recoded in its history two unprecedented worldwide phenomena: population aging and the transformation of a lethal pandemic by the human immunodeficiency virus into a chronic disease. Cross-sectional and analytical study that evaluated the functional capacity of the aged people with and without HIV, recruited for convenience from May/2018 to February/2020. Participants were 59 people with HIV and 61 people without HIV, of both sexes. Personal characteristics, life habits, comorbidities, geriatric clinical dimension and functional capacity among the aged with HIV and without HIV were compared. We found a higher prevalence of males, aged 60 to 65 years and low schooling in the HIV group, whereas in the HIV-free group, there was a predominance of females, age group above 70 years and higher level of formal education. Alcohol consumption, smoking, *cannabis* use and habitual condom use were more frequent among those with HIV. The prevalence of hypertension and polypharmacy was highlighted in elderly people without HIV. Functional capacity behaved without difference between the two groups.

Keywords

Functional Capacity, Aging, HIV.

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Introduction

The 20th century recorded in its history two unprecedented worldwide phenomena: population aging and the transformation of a lethal pandemic by the human immunodeficiency virus (HIV) into a chronic disease. The meeting of these two events – hiv-infected old people – brought to light a medical, social and public management challenge [1].

Physiological aging (senescence) and HIV infection share processes that enable immunosenescence, with immunological activation and perennial inflammation. The state of inflammation in the old person is called “inflammAGING”, while in the person with HIV it is called “inflammAIDS” [2-6].

The aging process and chronic diseases, including HIV infection, when coexisting in the old people, compromise its functionality [7]. Thus, functional capacity is an integral part of the concept of health of the elderly, impaired when the disease occurs significantly. Functional capacity concerns the ability to manage life without needing help and covers basic and instrumental activities of daily living, as well as cognition.

Considering the simultaneous existence of two prominent processes in the same organism – aging and HIV infection – this study aimed to evaluate functional capacity in the old people living with HIV and compare it with the old people without HIV.

Methods

Cross-sectional and analytical study that evaluated the functional capacity of the aged people with and without HIV, recruited for convenience from May/2018 to February/2020. Participants were 59 people with HIV and 61 people without HIV of both sexes.

Participants with HIV were contacted at outpatient clinics specialized in infectious diseases of two public university hospitals in Recife-Pernambuco. For this group, the inclusion criteria were: age ≥ 60 years, confirmed diagnosis of HIV recorded in medical records and using antiretroviral therapy (ART). Exclusion criteria were: presence of alteration of cognition and/or communication (identified by the Mini Mental State Examination), having untreated syphilis infection and/or neurological sequelae recorded in medical records.

The group without HIV infection was approached at a university center of care for the older people of Recife-PE, with the following inclusion criteria: age ≥ 60 years and rapid hiv negative test. Participants with cognitive impairment verified by the Mini Mental State Examination were excluded. Participants from both groups were interviewed in person by the researcher to complete the research instrument; for the group of people with HIV, additional information was collected from the review of their medical records.

Variables investigated for the sociodemographic profile: a) personal: gender, chronological age, self-reported skin color, schooling, family arrangement, steady partner; b) life habits: physical activity, classifying the participant as sedentary / insufficient active / active [8]; alcohol consumption considering teetotal / light drinker / heavy drinker [9]; smoking has never smoked / former smoker / current smoker [10]; cannabis use: never used /used any times/ has not used in the last year / used in the last year; condom use: always / sometimes / never. Elderly health: a) comorbidities (hypertension, heart failure, coronary artery disease, asthma, chronic obstructive pulmonary disease (COPD), liver disease, type 2 diabetes mellitus and chronic kidney disease); b) geriatric dimension: urinary and fecal incontinence, visual and auditory deficits, sleep, fall, polypharmacy. For the evaluation of functionality, was used: the Barthel Index for basic activities of daily living (ADL), composed of ten functions (feeding, bathing, clothing, personal hygiene, evacuation, urination, use of the toilet, bed-chair passage, ambulation, use of stairs) [11]; the Pfeffer Questionnaire for instrumental activities of daily living (IAVE), composed of 10 items (handling money, shopping, heating water for coffee and putting out the fire, preparing a food, up to date with current affairs, pay attention / understand / discuss information, remember appointments, find your way home, stay home safely) [12]; for cognition analysis, the Mini Mental State Examination (MSE) was used, with 19 items distributed in the following domains: orientation, memory, attention and calculus, praxia and language. Because it is influenced by schooling, different cutoff points were proposed to minimize this problem: 18 points for illiterate people, 21 points for individuals with 1 to 3 years of schooling, 24 points for those with 4 to 7 years of schooling and 26 for participants with more than 7 years of schooling [13].

For the HIV group, the date of diagnosis (HIV-positive serology) was collected in medical records. All data were recorded in form and typed in EpiInfo, with validation by double entry. The Research Ethics Committee of the Center approved the research for Health Sciences of the Federal University of Pernambuco, under the CAAE: 8140161.5.0000.5208.

Results

Table 1 shows the distribution of the personal profile of the evaluated participants, according to the study group. It was verified that the majority of the participants evaluated in the HIV group were male (66.1%), aged between 60 and 65 years (67.8%), were selfreported non-white (61.0%), had schooling between 1 and 4 years (33.9%), lived with the family (47.5%) and had no steady partner (67.8%). In the group of participants without HIV, the majority were female (80.3%), were over 70 years of age (55.7%), were selfreported non-white (68.9%), had > 8 years (50.8%), lived with the family (52.5%) and had no steady partner (68.9%). Even though specific differences were found in the personal distribution of the participants between the two groups evaluated, the homogeneity test was significant only in the variables gender and age (both with p-value < 0.001), indicating that the two groups differ about these factors. The distribution comparison test was significant for schooling (p-value = 0.048).

Table 1: Personal characterization of the participants, according to the study group.

Factor evaluated	Total		Rated group				p-value
	n	%	With HIV	%	No HIV	%	
Sex							
Male	51	42,5	39	66,1	12	19,7	<0,001 ¹
Female	69	57,5	20	33,9	49	80,3	
Age							
60 - 65 years	57	47,5	40	67,8	17	27,9	<0,001 ²
66 - 70 Years	23	19,2	13	22,0	10	16,4	
71 - 75 Years	20	16,7	5	8,5	15	24,6	
76 - 80 Years	14	11,7	1	1,7	13	21,3	
>80 Years	6	5,0	0	0,0	6	9,8	
Self-reported color							
White	42	35,0	23	39,0	19	31,1	0,420 ¹
Not White	78	65,0	36	61,0	42	68,9	
Schooling							
Illiterate	9	7,5	6	10,2	3	4,9	0,048 ²
1 - 4 years	30	25,0	20	33,9	10	16,4	
5 - 8 years	32	26,7	15	25,4	17	27,9	
> - years	49	40,8	18	30,5	31	50,8	
Family arrangement							
Alone	42	35,0	24	40,7	18	29,5	0,372 ¹
Family	60	50,0	28	47,5	32	52,5	
Partner	18	15,0	7	11,9	11	18,0	
Fixed companion							
Yes	38	31,7	19	32,2	19	31,1	0,901 ¹
No	82	68,3	40	67,8	42	68,9	

¹p-valor do teste Qui-quadrado para homogeneidade ²p-valor do teste Exato de Fisher.

In table 2, we have the distribution of the participants' life habits. The majority of participants in both groups were sedentary (69.5% and 50.8), were in alcohol withdrawal (76.3% and 95.1), and had never used cannabis (86.4% and 98.4). In the group of participants with HIV, 39% were former smokers and 45.8% had never used condoms in sexual intercourse.

In participants without HIV, 63.9% never smoked and 90.2% never used condoms in sexual intercourse. The homogeneity test was significant in the following factors: Alcohol consumption (p-value = 0.005), smoker (p-value < 0.001), cannabis use (p-value = 0.023) and condom use in sexual intercourse (p-value < 0.001), indicating that the distribution of these factors differs between the groups evaluated.

Table 2: Characterization of the participants' life habits, according to the study groups.

Factor evaluated	Total		Rated group				p-value
			With HIV		No HIV		
	n	%	n	%	n	%	
Physical activity							0,117 ²
Sedentary	72	60,0	41	69,5	31	50,8	
Insufficient asset	5	4,2	2	3,4	3	4,9	
Active	43	35,8	16	27,1	27	44,3	
Alcohol consumption							0,005 ²
Abstinence	103	85,8	45	76,3	58	95,1	
Light drinker	11	9,2	8	13,6	3	4,9	
Heavy drinker	6	5,0	6	10,1	0	0,0	
Smoking							<0,001 ¹
Never smoked	60	50,0	21	35,6	39	63,9	
Ex-smoker	43	35,8	23	39,0	20	32,8	
Current smoker	17	14,2	15	25,4	2	3,3	
Cannabis							0,023 ²
Never used	111	92,6	51	86,4	60	98,4	
He used it a few times	7	5,8	6	10,2	1	1,6	
Haven't used it in the last year.	1	0,8	1	1,7	0	0,0	
Used in the last year	1	0,8	1	1,7	0	0,0	
Condom use in sexual intercourse							<0,001 ¹
Always	27	22,5	25	42,4	2	3,3	
Sometimes	11	9,2	7	11,9	4	6,6	
Never	82	68,3	27	45,8	55	90,2	

¹Qui-square test p-value for homogeneity; ²Fisher's Exact Test p-value.

Table 3 shows the distribution of participants' diseases, according to the study group. It turns out that in the two groups of old people, the majority had no heart failure (94.9% and 96.7%), coronary heart disease (96.6% and 95.1%), asthma (96.6% and 96.7%), COPD (94.9% and 100.0%), liver disease (94.9% and 96.7%),

diabetes (79.7% and 70.5%) and kidney disease (94.9% and 96.7%). In the group of participants with HIV, the majority did not present hypertension (59.3%), while among those without HIV, the majority had hypertension (67.2%). The homogeneity test was significant only for arterial hypertension (p-value = 0.004), indicating that the distribution of arterial hypertension differs between the group of participants with and without HIV.

Table 3: Disease inventory of the participants, according to the study group.

Factor evaluated	Total		Rated group				p-value
			With HIV		No HIV		
	n	%	n	%	n	%	
Hypertension							
Yes	65	54,2	24	40,7	41	67,2	0,004 ¹
No	55	45,8	35	59,3	20	32,8	
Cardiac inefficiency							
Yes	5	4,2	3	5,1	2	3,3	0,677 ²
No	115	95,8	56	94,9	59	96,7	
Coronary heart disease							
Yes	5	4,2	2	3,4	3	4,9	1,000 ²
No	115	95,8	57	96,6	58	95,1	
Asthma							
Yes	4	3,3	2	3,4	2	3,3	1,000 ²
No	116	96,7	57	96,6	59	96,7	
COPD							
Yes	3	2,5	3	5,1	0	0,0	0,116 ²
No	117	97,5	56	94,9	61	100,0	
Liver disease							
Yes	5	4,2	3	5,1	2	3,3	0,677 ²
No	115	95,8	56	94,9	59	96,7	
Diabetes							
Yes	30	25,0	12	20,3	18	29,5	0,246 ¹
No	90	75,0	47	79,7	43	70,5	
Kidney disease							
Yes	5	4,2	3	5,1	2	3,3	0,677 ²
No	115	95,8	56	94,9	59	96,7	

¹Qui-square test p-value for homogeneity; ²Fisher's Exact Test p-value.

Table 4 shows the geriatric clinical dimension of the evaluated participants, according to the study group. It was verified that most of the old people in both groups did not have urinary incontinence (88.1% and 75.4%), fecal incontinence (98.3% and 93.4%), used corrective lenses (64.4% and 72.1%), had normal hearing (91.5% and 85.2%), normal sleep (67.8% and 73.8%), did not suffer a fall (79.7% and 68.9%). In the HIV group, 10.2% used 4 or more medications, while participants without HIV, 41% used more than 4 medications. The homogeneity test was significant only in the use of medications (p-value < 0.001), indicating that the number of medications differs among the groups evaluated.

Table 4: Distribution of the geriatric clinical dimension of the participants, according to the study groups.

Factor evaluated	Total		Rated group				p-value
			With HIV		No HIV		
	n	%	n	%	n	%	
Urinary incontinence							
Yes	22	18,3	7	11,9	15	24,6	0,072 ¹
No	98	81,7	52	88,1	46	75,4	
Fecal incontinence							
Yes	5	4,2	1	1,7	4	6,6	0,365 ²
No	115	95,8	58	98,3	57	93,4	
Normal vision							
Yes	25	20,8	13	22,0	12	19,7	0,566 ¹
No	13	10,8	8	13,6	5	8,2	
Uses corrective lenses	82	68,4	38	64,4	44	72,1	
Normal hearing							
Yes	106	88,3	54	91,5	52	85,2	0,284 ¹
No	14	11,7	5	8,5	9	14,8	
Normal sleep							
Yes	85	70,8	40	67,8	45	73,8	0,472 ¹
No	35	29,2	19	32,2	16	26,2	
Fall							
Yes	31	25,8	12	20,3	19	31,1	0,176 ¹
No	89	84,2	47	79,7	42	68,9	
Medications							
No	25	20,8	20	33,9	5	8,2	<0,001 ¹
1 medication	23	19,2	11	18,6	12	19,7	
2 medications	20	16,7	13	22,0	7	11,5	
3 medications	21	17,5	9	15,3	12	19,7	
4 medications	13	10,8	3	5,1	10	16,4	
More than 5 medications	18	15,0	3	5,1	15	24,6	

¹Qui-square test p-value for homogeneity; ²Fisher's Exact Test p-value.

Table 5: Comparison of functionality indicators between groups of participants.

Factor evaluated	Total		Rated group				p-value
			With HIV		No HIV		
	n	%	n	%	n	%	
Normal Barthel index							
Yes	118	98,3	59	100,0	59	96,7	0,496 ²
No	2	1,7	0	0,0	2	3,3	
Normal Pfeffer Questionnaire							
Yes	117	97,5	57	96,6	60	98,4	0,616 ²
No	3	2,5	2	3,4	1	1,6	
Normal Mini Mental							
Yes	110	91,7	54	91,5	56	91,8	1,000 ²
No	10	8,3	5	8,5	5	8,2	

¹Qui-square test p-value for homogeneity; ²Fisher's Exact Test p-value.

Table 5 shows the instruments for assessing functionality: Barthel Index (ABVD), Pfeffer Questionnaire (IADL) and Mininame of Mental State (MSE). It was verified that in both groups, the majority were independent in activities of daily living / Barthel (100.0% and

96.7%), instrumental activities of daily living/Pfeffer (96.6% and 98.4%) and cognition / MSE (91.5% and 91.8%). The homogeneity test was not significant in any of the factors (all p-value was greater than 0.05), indicating that the distribution of the evaluated indicators is similar among the groups of participants.

Discussion

Personal characteristics, life habits, comorbidities, geriatric clinical dimension and functional capacity among the aged with HIV and without HIV were compared. We found a higher prevalence of males, aged 60 to 65 years and low schooling in the HIV group, whereas in the HIV-free group, there was a predominance of females, age group above 70 years and higher level of formal education. Alcohol consumption, smoking, cannabis use and habitual condom use were more frequent among those with HIV. The prevalence of hypertension and polypharmacy was highlighted in elderly people without HIV. The functional capacity behaved without difference between the two groups.

The majority of the people with HIV were male, compatible with the epidemiological profile of Brazil from 2007 to 2021, when 7,474 male and 4,794 female people were registered [14]. In the age group from 60 to 65 years (younger older people) were the majority of participants with HIV, while in the group without HIV, which represents population aging, older ages prevailed and females ("feminization" of old age) [15].

Low schooling, more prevalent in older people with HIV, contributes to a lower understanding of information about the disease, making people more susceptible to HIV [16]. There is a relationship between low schooling and low socioeconomic status, reflecting poor access to satisfactory preventive and care services for the old person with HIV.

Alcohol is the psychoactive substance most used by Person Living With HIV (PLWHIV) and is associated with risky sexual attitudes, acting on behavior, favoring greater vulnerability to the occurrence of sexually transmitted infections, including HIV. Alcohol use in this population is related to a worse prognosis, increased morbidity and mortality, acceleration of disease progression, low treatment for antiretroviral therapy (ART), decline of CD4+ T lymphocytes and increased viral load, in addition to the spread of HIV infection, because drunk people are more likely to maintain unprotected sexual relations, favoring the transmission of the virus. Studies show that alcohol consumption among PLWHIV is high, and may be twice the general population [17,18].

There are few studies on the consequences of cannabis in PLWHIV, but a study published in 2022 reported its adverse effect on disease progression because it favors lowadhering to ART, depression, immunosuppression and neurocognitive dysfunction, favoring premature biological aging [19].

It is estimated that the worldwide prevalence of smoking in PLWHIV is 40% to 70% and, in the general population, around

20%. In Brazil, previous studies have estimated that the prevalence of smoking in PLWHIV ranged from 28.9% to 33.6%, while in the general population over 18 years this rate is 10.1%. Cigarette burning releases elements that alter the shape and physiology of macrophages, B and T lymphocytes (CD4 and CD8) and lymphocins, in addition to promoting the expression of the HIV-1 gene of response to ART with impairment in viral suppression [20].

Condom use was reported more frequently in those with HIV. A particularity in this research was the unanimity in the statement that this habit started after the diagnosis of this infection. There are studies that indicate that the risk of sexual practice without protection increased in people under ART, because they feel good and because they enjoy increased immunity, many are the reasons for this attitude, from sociodemographic factors, lack of perception of the severity of the disease, difficulty in negotiating the use of the preservativo, among others [21]. In our group without HIV, more feminine and older, the non-use of this preventive measure prevailed.

Chronic non-communicable diseases are more frequent during physiological aging (senescence), as well as in PLWHIV, since ART and the virus itself, even with undetectable viral load, activate inflammatory mechanisms with the promotion of early senescence represented by biological age greater than chronological age in up to 10 to 15 years [22,23]. The group without HIV had a higher prevalence of hypertension.

For the World Health Organization (WHO), polypharmacy is the concomitant and routine use of 4 or more medications (with or without a medical prescription) [24]. This condition is seen more often in patients with chronic diseases and due to aging, which in many cases imposes polymedication. In this study, the variable “polypharmacy” was more prevalent in the group of older people without HIV, whose majority were over 70 years old. In the HIV group, ART does not participate in drug counting.

Functional capacity – being able to perform daily tasks without help, even with some degree of difficulty – has been used as a fundamental indicator for the analysis of the health and well-being conditions of the old person, constituting a critical measure for societies facing the challenges of dealing with an increasing number of people, which could, among other factors, lead to higher health expenditures.

People aging with HIV and using ART represent a challenge in promoting and maintaining the functionality of this population [25]. Our research showed that the functionality between the two groups of elderly people, with and without HIV, presented similar behavior, that is, both presented good functionality: independence and autonomy.

Conclusion

Although we are in the course of the 5th decade of the HIV pandemic, it is still necessary to keep research on the subject,

because the increase of infected older people occur so many different paths: those who age with HIV and those who acquire the infection when they are already older people. Some aspects are being identified and need to be discussed. The sexuality of the old person is not addressed by health professionals, and is seen after the diagnosis of HIV/aids. In Brazil, the request for HIV serology is encouraged for vulnerable groups but makes no mention of the old people. It is necessary to rescue the old person from invisibility and bring them to social light, because in the face of longevity these people can contribute to society and have the right to care for the preservation of its functionality.

References

1. Wing E. HIV and aging. *International Journal of Infectious Diseases*. 2016; 53: 1-68.
2. Borges AH, JLO Connor, AN Phillips, et al. Factors Associated with Plasma IL-6 Levels During HIV Infection. *Journal of Infectious Diseases*. 2015; 212: 585-595.
3. Nordell AD, McKenna M, Borges AH, et al. Severity of Cardiovascular Disease Outcomes Among Patients with HIV Is Related to Markers of Inflammation and Coagulation. *Journal of the American Heart Association*. 2014; 3: e000844.
4. So-Armah KA, Tate JP, Butt AA, et al. Do Biomarkers of Inflammation, Monocyte Activation, and Altered Coagulation Explain Excess Mortality Between HIV Infected and Uninfected People? *Journal of Acquired Immune Deficiency Syndromes* (1999). 2016; 72: 206-213.
5. Pinti M, Nasi M, Lugli E, et al. T Cell Homeostasis in Centenarians: From the Thymus to the Periphery. *Current Pharmaceutical Design*. 2010; 16: 597-603.
6. Franceschi C, Olivieri F, Marchegiani F, et al. Genes involved in immune response/inflammation, IGF1/insulin pathway and response to oxidative stress play a major role in the genetics of human longevity: the lesson of centenarians. *Mechanisms of Ageing and Development, The Voyage to Old Age: Searching for Human Longevity Genes*. 2005; 126: 351-361.
7. Nasi M, Pinti M, Biasi SD, et al. Aging with HIV infection: A journey to the center of inflammAIDS, immunosenescence and neuroHIV. *Immunology Letters, Immunity during Aging and Longevity*. 2014; 162: 329-333.
8. Matsudo S, Araújo T, Matsudo V, et al. Questionário Internacional de Atividade Física (IPAQ): estudo de validade e reprodutibilidade no Brasil / International physical activity questionnaire (IPAQ): study of validity and reliability in Brazil. *Revista Brasileira de Atividade Física & Saúde*. 2001; 6: 5-18.
9. Ariyothai N, Podhipak A, Akarasewi P, et al. Cigarette smoking and its relation to pulmonary tuberculosis in adults. *Southeast Asian J Trop Med Public Health*. 2004; 35: 219-227.
10. Mahoney FI, Barthel DW. Functional Evaluation: The Barthel Index. *Md State Med J*. 1965; 14: 61-65.
11. Pfeffer RI, Kurosaki TT, Harrah Jr CH, et al. Measurement of functional activities in older adults in the community. *Journal of Gerontology*. 1982; 37: 323-329.

12. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state": A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res.* 1975; 12:189-198.
13. Epidemiological Bulletin Health Surveillance Secretariat Ministry of Health Special Number Dec. 2021.
14. Sousa NFS, Lima MG, Cesar CLG, et al. Active aging: prevalence and gender and age differences in a population-based study. *Cad. Saúde Pública.* 2018; 34: e 00173317.
15. Silva NB, Sarmento WM, Silva FCV, et al. Panorama epidemiological disease of AIDS in the elderly. *Revista Brasileira de Geografia Médica e da Saúde Hygeia.* 2018; 14: 80-88.
16. Mesquita AL, Melo ES, Costa CRB, et al. Alcohol consumption people living with HIV and its implications for clinical outcomes. *Rev Eletr Enferm.* 2020.
17. Santos VF, Galvão MTG, Cunha GH, et al. Alcohol effect on HIV-positive individuals: treatment and quality of life. *Acta Paul Enferm.* 2017; 30: 94-100.
18. Peixoto IR, Melo LSW, Lacerda HR. *Aids Care.* Factors associated with early biological aging in older people with HIV. 2022; 1-7.
19. Teixeira LSL, Ceccato MGB, Carvalho WS, et al. Prevalence and factors associated with smoking in people living with HIV undergoing treatment. *Rev Saude Publica.* 2020; 54:108.
20. Liberali BM, Neves SCM, Oliveira LS, et al. HIV/AIDS knowledge evaluation and condom use in an elderly group in the City of São Paulo. *Rev Med (São Paulo).* 2020; 99: 104-108.
21. Guaraldi G, Orlando G, Zona S, et al. Premature AgeRelated Comorbidities Among HIV-Infected Persons Compared with the General Population. *Clin Infect Dis.* 2011; 53: 1120-1126.
22. Rinaldi S, Pallikkuth S, George VK, et al. Paradoxical aging in HIV: immune senescence of B Cells is most prominent in young age. *Aging.* 2017; 9: 1307-1325.
23. World Health Organization. *Medication Without Harm – Global Patient Safety Challenge on Medication Safety.* Geneva: World Health Organization. 2017.
24. ROSSI SMG, Maluf ECP, Carvalho DS, et al. Impact of antiretroviral therapy under different treatment regimens. *Revista Panamericana De Salud Publica = Pan American Journal of Public Health.* 2012; 32: 117-123.