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ORIGINAL ARTICLE / *ARTIGO ORIGINAL*

Moderate endemicity of the human T-lymphotropic virus infection in the metropolitan region of Belém, Pará, Brazil

Moderada endemicidade da infecção pelo vírus linfotrópico-T humano na região metropolitana de Belém, Pará, Brasil

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ABSTRACT: ***Introduction:*** The spread of the HTLV infection in families living in the metropolitan area of Belém, Pará, Brazil, and the lack of studies in the general population requires studies to better understand its prevalence in the region. ***Methods:*** An anti-HTLV-1/HTLV-2 antibodies test was carried out on random adults in public places in Belém between November 2014 and November 2015. A proviral DNA test detected if the person was infected, and then a clinical evaluation and an intrafamilial investigation were carried out. ***Results:*** Of the 1059 individuals being investigated, 21 (2.0%) had seroreagent samples, 15 (1.4%) had HTLV-1, 5 (0.5%) had HTLV-2, and proviral DNA was undetectable in one case. The mean age of the infected people (57.2) was higher than that of those that were uninfected (46.2) ($p = 0.0010$). The prevalence of infection increased with age, especially in individuals with a family income equal to or less than a minimum wage. Intrafamilial transmission seems to have occurred in all of the families being studied. Among the patients with HTLV-1, 30% (3/10) already had some symptom related to the infection. ***Discussion:*** The increase in prevalence rates according to age may be due to late seroconversion of a previously acquired infection, or the cumulative risk of new infections, especially in women. ***Conclusion:*** There was a moderate prevalence of the HTLV infection among adult individuals from the metropolitan area of Belém, with a predominance of HTLV-1. This infection was associated with low income and increasingly older women. It also presented intrafamily spread and negligence in the diagnosis of associated diseases.

Keywords: Deltaretrovirus. Epidemiology. Cross-sectional studies. Family health.

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RESUMO: ***Introdução:*** A disseminação da infecção pelo vírus linfotrópico-T humano (HTLV) em famílias da área metropolitana de Belém, Pará, Brasil, e a ausência de estudos na população em geral requisitam investigações que esclareçam melhor a sua prevalência na região. ***Metodologia:*** Foi realizada pesquisa de anticorpos anti-HTLV-1/HTLV-2 em indivíduos adultos transeuntes de logradouros públicos de Belém, entre novembro de 2014 e novembro de 2015. A infecção foi confirmada por pesquisa de DNA proviral e foi realizada avaliação clínica e investigação intrafamiliar dos infectados. ***Resultados:*** Dos 1.059 indivíduos investigados, 21 (2,0%) apresentaram amostras sororeagentes, 15 (1,4%) confirmados para HTLV-1, 5 (0,5%) para HTLV-2 e o DNA proviral foi indetectável em 1 caso. A média de idade dos infectados (57,2) foi maior que a dos não infectados (46,2) (p = 0,0010). A infecção aumentou com a idade e se destacou nos indivíduos com renda familiar menor ou igual a um salário mínimo. A transmissão intrafamiliar parece ter ocorrido em todas as famílias investigadas. Dentre os portadores de HTLV-1, 30% (3/10) já apresentavam algum sintoma relacionado à infecção. ***Discussão:*** O aumento da infecção de acordo com a idade pode ocorrer por soroconversão tardia de infecção pré-adquirida ou pelo risco cumulativo de novas infecções, sobretudo em mulheres. ***Conclusão:*** A infecção por HTLV demonstrou moderada prevalência na população estudada, com predomínio do HTLV-1. Essa mostrou-se associada à baixa renda e ao aumento da idade das mulheres. Também apresentou disseminação intrafamiliar e negligência no diagnóstico das doenças associadas.

Palavras-chave: Deltaretrovírus. Epidemiologia. Estudos transversais. Saúde da família.

INTRODUCTION

The human T-lymphotropic virus (HTLV) was the first retrovirus identified in humans[1,2]. It is an enveloped retrovirus, which contains two single-stranded, equal, positive ribonucleic acid (RNA) molecules. HTLV belongs to the *Deltaretrovirus* genus of the *Retroviridae* family, and the *Orthoretrovirinae* subfamily.[3] Four types are currently described (HTLV-1, HTLV-2, HTLV-3, HTLV-4), however, only HTLV-1 and HTLV-2 are associated with cases of disease[4].

HTLV-1 is associated with the development of serious diseases such as adult T-cell leukemia/lymphoma (ATL) and HTLV-1-associated myelopathy/tropical spastic paraparesis (HAM/TSP), as well as correlated diseases such as uveitis, infectious dermatitis and strongyloidiasis[5,6]. As for HTLV-2, it has been associated with rare cases of neurological disorders that are similar to HAM/TSP, even though there are no precise indications of well-defined clinical manifestations[7,8].

The main ways HTLV is transmitted are sexual; vertical (mother to child); through blood transfusion; or the use of contaminated needles and/or syringes[9]. Intrafamilial transmissions occur by sexual and vertical pathways[10]. Vertical transmission occurs mainly through breastfeeding, as infected lymphocytes are transferred to the newborn. Intrauterine transmission is rare. Time spent breastfeeding influences the possibility for the virus to be transmitted[6,9,11]. A study carried out in Japan proposed that sexual transmission is more efficient when it goes from male to female, since the opposite is less common[12].

A HTLV infection is diagnosed by detecting anti-HTLV-1 / HTLV-2 antibodies, by means of an immunoenzymatic assay (ELISA) plus a Western blot and / or a polymerase chain reaction (PCR), for the respective detection of proteins and proviral DNA, with a subsequent differentiation of virus genotypes[13].

Between 5 and 10 million individuals are infected with HTLV worldwide, and it is widely distributed, with high endemicity clusters in southwestern Japan, sub-Saharan Africa, South America, the Caribbean basin and specific areas of Iran and Melanesia. In the Americas, it is found with higher rates in Caribbean countries and with lower rates in Brazil[4].

In Brazil, it is estimated that there are approximately 2.5 million infected people, and thus it is the territory with the highest absolute number of infected people. The states of Bahia, Pará and Maranhão present the highest prevalence rates for this infection in blood donors[14-16]. In addition to studies conducted with blood donors in the state of Pará, there are also studies of HTLV infection in specific groups of pregnant women[17], indigenous people[18], people with neurological diseases[19], and people with the human immunodeficiency virus (HIV)[20]. Other studies have also shown the presence of this infection in rural populations in the state of Pará[21-23], but the prevalence of HTLV is not known with regard to the population of the metropolitan area of Belém, the largest urban area in the state.

The high endemicity of HTLV infection in households in the metropolitan area of Belém[24] and the lack of studies about this infection in the population require an investigation that better characterize its epidemiology in the region. Thus, this study described the prevalence and factors associated with HTLV infection in adult individuals from the metropolitan area of Belém, Pará, Brazil.

MATERIAL AND METHODS

CASUISTRY, PERIOD AND PLACE OF STUDY

This is a prospective, cross-sectional, analytical study carried out from November 2014 to November 2015, with adult individuals, who were passing through public places (the Ver-o-Peso Complex and the Republic Square) in the city of Belém, Pará, Brazil. Ver-o-Peso's architectural and landscape complex covers an area of 35,000 square meters, with a series of historic buildings, including markets, squares and streets. Located on the shores of the Guajará Bay, it is an important touristic and cultural supply point in Belém. It has the largest outdoor fair in Latin America, which sells various types of food and medicinal herbs, which are mainly gathered from the river. Republic Square is one of the most important public urban leisure spaces for the population of Belém and people of all different kinds visit it.

The participants of this study were attended by university extension actions, which were carried out by the Laboratory of Molecular and Cellular Biology (LBMC) of the Nucleus of Tropical Medicine (*Núcleo de Medicina Tropical* - NMT) at the Universidade Federal do Pará (UFPA). During these actions, 3,500 informative leaflets on HTLV were distributed with clarification about the infection, how it is transmitted, associated diseases, and the necessary examinations.

DATA COLLECTION AND SAMPLES

After explaining the objective, the risks, and the benefits of the study, the individuals gave their consent by reading and signing the Informed Consent Form (*Termo de Consentimento Livre e Esclarecido* - TCLE). Socio-epidemiological data were collected by our own research protocol, with an investigation into the following variables: age, gender, marital status, history of having received a blood transfusion, schooling, and monthly family income. Clinical information was obtained from medical records after consultation at the clinic of the university unit.

Blood was collected by venipuncture (approximately 5 mL) in a tube containing ethylenediaminetetraacetic acid (EDTA), and it was stored at a temperature of 8°C. The samples were identified with the initials of the name and the respective registration number of the participant. The blood collected was centrifuged at 3,000 rpm for 10 minutes and separated into plasma aliquots and a leukocyte layer, respectively, for anti-HTLV-1/2 antibody screening and, if necessary, proviral DNA testing.

LABORATORY TESTS

Anti-HTLV antibody screening was performed by the Gold ELISA Anti-HTLV 1/2 Kit (REM, São Paulo, Brazil), according to the manufacturer's instructions. Reactive samples and samples with values of 20% below or above the cut off (suspect cases) underwent a new immunoenzymatic test and proviral DNA testing.

DNA was extracted from leukocyte layer cells (300 μL), following the recommendations of the Wizard® Genomic DNA Purification Kit (Promega, Madison, Wisconsin, USA).

The human β-globin gene was amplified to evaluate the extracted DNA in its integrity, using PC04 (5'-CAACTTCATCCACGTTCACC-3') and GH20 (5'-GAAGAGCCAAGGACAGGTAC-3') oligonucleotides, and it generated 268 base pair (bp) fragments after the PCR25.

The proviral DNA testing was performed by nested-PCR, with an amplification of the pX region of the HTLV, in order to confirm if a viral infection was present in the seroreagent samples or the suspected samples. An enzymatic digestion reaction of the nested-PCR product was performed to differentiate between types I and II[26].

The first step of the nested-PCR was performed with 3.5 μl of Go Taq Green Master Mix, 1.0 μl of water, 0.25 μl (10 pmol) of each external HTLV primer F 5'-TTCCCAGGGTTTGGACGAAG-3' (7219-7238, direct) and external HTLV R 5'-GGGTAAG GACCTTGAGGGTC-3' (7483-7464, reverse), and 2.0 μl of DNA, reaching a final volume of 7 μl. The protocol for amplification followed the denaturation temperature of 94°C for 4 minutes, followed by 30 cycles (repetitions), denaturation of 94°C for 40 seconds, hybridization at 51.6°C for 30 seconds, and finally, extension at 72°C for 40 seconds followed by the final extension of 72°C for 10 minutes, and 10°C for 10 minutes.

The second step of the nested-PCR was performed with 6.0 μL of Go Taq Green Master Mix, 0.25 μL (10 pmol) of each oligonucleotide, internal HTLV F 5'-CGGATACCCAGTCTACGTGTT-3' (7248-7268, direct) and internal HTLV R 5'-GAGCCGATAACGCGTCCATCG-3' (7406-7386, reverse), 5.2 μL of water and 0.3 μL of the product of the first PCR, completing a reaction with a final volume of 12 μL, and generating a fragment of 159 bp. The amplification protocol of this reaction followed 35 cycles (repetitions), with a denaturation of 94°C for 30 seconds, a hybridization of 51.6°C for 30 seconds, an extension of 72°C for 30 seconds, followed by the final extension at 72°C for 10 minutes, and 10°C for 10 minutes.

Positive controls (HTLV-1 and HTLV-2 samples) and negative controls (sterile water) were used in each PCR reaction.

The restriction fragment length polymorphism (RFLP) reaction of the pX region product (159 bp) was performed by mixing 6.0 μl of the amplified product, 2.8 μl of water, 0.1 μl of bovine serum albumin (BSA) protein, 1 μl restriction buffer (10 x) and 0.1 μl of the TaqI restriction enzyme (10 U/μL, Promega, Madison WI, USA), with subsequent incubation at 65°C for 2 hours. Samples with 85, 53 and 21 bp fragments were considered positive for HTLV-2. Samples with 138 and 21 bp fragments were considered positive for HTLV-1.

The products of the human β-globin reactions, the nested-PCR and the enzymatic digestion were applied on agarose gel at 1, 2 and 3%, respectively. The gel contained ethidium bromide (1 mg/mL) and was submitted at 100 V for 60 minutes and visualized in an ultraviolet transilluminator.

AN EVALUATION OF THE INFECTED PEOPLE AND THEIR FAMILIES

The individuals who were identified as having the infection, also known as index cases (IC), were referred to the NMT to receive a clinical-outpatient evaluation by specialized professionals. Family research prioritized HTLV testing in the spouses and the mother of the male IC. The mother, spouse and children were prioritized for the female IC. In the case of a deceased mother, the IC's siblings were investigated.

STORAGE AND DATA ANALYSIS

The information collected in the interview, in the laboratory and in the charts were inserted into a worksheet to identify frequency and to make graphs and tables, using the Microsoft Office Excel® 2016 and Bioestat 5.0 programs. The G-test was used to analyze the significance of the proportions (relative frequencies) and p-values less than or equal to 0.05 ($p \leq 0.05$) were considered to be significant. The Lilliefors and Mann-Whitney tests, respectively, were used to evaluate the normality and the difference between the age means, from the positive and negative cases.

ETHICAL QUESTIONS

The present study is part of the project "Researching Infections and Infectious Diseases through University Extension", which was approved by the Research Ethics Committee for Studies Involving Human Beings of the Tropical Medicine Nucleus at the Universidade Federal Pará, through *Plataforma Brasil*, obeying Resolution No. 466/2012 of the National Council of Ethics in Research (CAAE: 38202214.6.0000.5172), report number 1,218,417, from September 8, 2015.

RESULTS

A total of 1,059 individuals were investigated, of which, 21 (2.0%) were identified with anti-HTLV-1/2 antibodies. Among these, 20 presented proviral DNA, and 15 (1.4%) cases of HTLV-1 and 5 (0.5%) cases of HTLV-2 were confirmed. The individual that did not present proviral DNA did not show up for further blood collection.

Of all those investigated, 61.1% were women, 51.2% had a stable marital relationship, 80.2% said they had never received a blood transfusion, 54% had completed high school or higher, and 70.9% said they received one 1 minimum wage or less. Among these characteristics, HTLV infection was observed in people with a family income of less than or equal to 1 Brazilian minimum wage ($p = 0.0114$), when compared to the group with higher income (Table 1).

A total of 1,019 (96%) investigated individuals resided in the metropolitan area of Belém, with 84.7% (863/1,019) of them from the city of Belém, 12.6% (128/1,019) from Ananindeua, 1.8% (18/1,019 from Marituba, 0.7% (7/1.019) from Benevides and 0.3% (3/1,019) from Santa Bárbara do Pará. The remaining 4% ($n = 40$) of the investigated persons resided in other municipalities of the state of Pará. All of the individuals with anti-HTLV1/2 antibodies resided in the metropolitan region of Belém. Nineteen were inhabitants of the municipality of Belém and two were from the municipality of Ananindeua.

The ages of the investigated individuals ranged from 18 to 88 years old, with a mean of 46.4 ($\pm$ 15.2) years old, and 10.4% ($n = 110$) of them were over 65 years of age. The ages of the infected individuals ranged from 35 to 77 years old, with a mean of 57.2 ($\pm$ 11.6) years old. In the negative cases for the infection, the mean age was 46.2 ($\pm$ 15.2) years old ($p = 0.0010$) (Figure 1).

In general, there were more infections observed when the population was separated into individuals older than 30 years old ($p = 0.0260$), 40 years old ($p = 0.0036$) and 50 years old ($p = 0.0054$), compared to groups of older-aged individuals. In women, infection frequency was also higher in those older than 40 years old ($p = 0.0018$) and 50 years old ($p= 0.0083$), when compared to younger groups. The proportions of infection by age group in men did not show significant differences (Table 2).

Of the 21 seroreagent individuals, 14 (10 HTLV-1 and 4 HTLV-2) appeared for clinical evaluation. Among the patients with HTLV-1, 30% (3/10) presented some symptom or disease associated with the infection, with 1 case of HAM / TSP, 1 case of uveitis and 1 case of chronic arthropathy and bladder dysfunction. These individuals were already in treatment for their diseases, but had a different clinical diagnosis, and no prior knowledge of HTLV-1 infection.

Six families (5 HTLV-1 and 1 HTLV-2) continued the investigation for intrafamilial transmission and all (100%) had at least one other individual infected with the same viral IC type. Of these six families, 14 relatives of the ICs were investigated, of which nine (64%) were infected. Intrafamilial transmission may have occurred in 100% (4/4) of marital relationships and in 42% (5/12) of vertical relationships (including families 6,653, 6,663, 7,006 and 7,013) (Table 3).

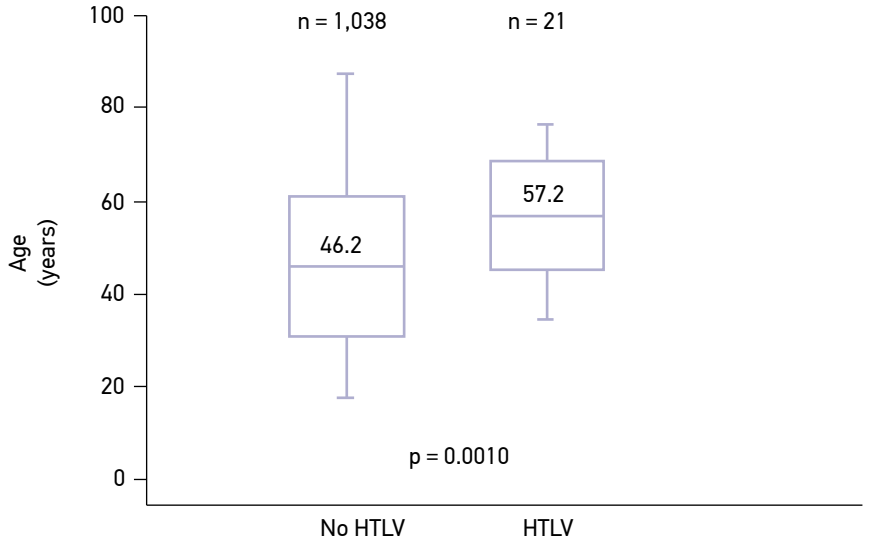
Table 1. The epidemiological characteristics of the people investigated for and the people found to be infected with the human T-lymphotropic virus, and who were surveyed in public places in Belém, Pará, Brazil, between November 2014 and November 2015.

	Investigated		Infected		p-value
	n	%	n	%	
Gender					
Female	647	61.1	14	2.2	0.7608
Male	412	38.9	7	1.7	
Marital Status					
Married/common-law marriage	542	51.2	11	2.0	0.9130
Single/separated/divorced/widowed	517	48.8	10	1.9	
History of having received a transfusion					
No	849	80.2	19	2.2	0.9499
Yes	110	10.4	2	1.8	
Not informed	100	9.4	–	–	
Schooling (years)					
0 to 11	487	46	13	2.7	0.2092
≥ 12	572	54	8	1.4	
Income (minimum wage)					
≤ 1	751	70.9	20	2.7	0.0114*
> 1	308	29.1	1	0.3	

*Significant value for the G test.

DISCUSSION

Investigations into the frequency of HTLV infections in the state of Pará are specifically performed in groups of blood donors[15], pregnant women[17], rural communities and/



HTLV: human T-lymphotropic virus.

Figure 1. Box-plot of the mean ages of individuals, who did and did not have the human T-lymphotropic virus infection, and who were investigated in public places in the city of Belém, Pará, Brazil, from November 2014 to November 2015.

Table 2. Age of those investigated and infected with the human T-lymphotropic virus, who were surveyed in public places in Belém, Pará, Brazil, between November 2014 and November 2015.

Age range (years)	Total					Women					Men				
	Investigated		Infected		p-value	Investigated		Infected		p-value	Investigated		Infected		p-value
	n	%	n	%		n	%	n	%		n	%	n	%	
< 30	185	17.5	–	–	0.0260*	134	21	–	–	0.0584	51	12	–	–	0.6486
≥ 30	874	82.5	21	2.4		513	79	14	2.7		361	88	7	1.9	
< 40	354	33.4	1	0.3	0.0036*	246	38	–	–	0.0018*	108	26	1	0.9	0.7668
≥ 40	705	66.6	20	2.8		401	62	14	3.5		304	74	6	2.0	
< 50	591	55.8	5	0.8	0.0054*	384	59	3	0.8	0.0083*	207	50	2	1.0	0.4351
≥ 50	468	44.2	16	3.4		263	41	11	4.2		205	50	5	2.4	

*Significant value for the G test.

or individuals living in *quilombos*[18], HIV positive people[20] and people with neurological diseases[27]. We investigated the prevalence of HTLV infection in adults passing through public places in the city of Belém, Pará, Brazil, because Pará is one of three Brazilian states with the greatest endemicity for this infection in blood donors[15]. Additionally, the metropolitan area of Belém has a high aggregation of families with the infection[24] and lastly; there is a lack of studies in non-referenced demand from the highest population density area in the state.

The observed prevalence (2%) in adult individuals in the metropolitan area of Belém did not differ significantly from those observed in population-based studies conducted in riverside communities in the northeast of the state (1.14%)[22] or from sentinel areas in the

Table 3. Families investigated for human T-lymphotropic virus infection, from people identified in public places of Belém, Pará, Brazil, between November 2014 and November 2015.

Family	Gender	Age	Relation	Serology	PCR
6.653	F	40	Index case	Reaction	HTLV-1
	F	59	Mother	Non-reactive	Undetectable
	M	42	Spouse	Reactive	HTLV-1
	M	23	Son	Non-reactive	Undetectable
	F	22	Daughter	Non-reactive	Undetectable
	F	21	Daughter	Reactive	HTLV-1
6.663	F	52	Index case	Reaction	HTLV-1
	F	64	Sister	Reactive	HTLV-1
	F	61	Sister	Reactive	HTLV-1
	M	51	Brother	Reactive	HTLV-1
6.662	M	64	Index case	Reaction	HTLV-1
	F	56	Ex-spouse	Reactive	HTLV-1
6.715	M	73	Index case	Reaction	HTLV-2
	F	66	Spouse	Reactive	HTLV-2
7.006	F	66	Index case	Reaction	HTLV-1
	F	47	Daughter	Non-reactive	Undetectable
	M	81	Spouse	Reactive	HTLV-1
7.013	F	49	Index case	Reaction	HTLV-1
	F	48	Sister	Reactive	Undetectable
	F	54	Brother	Non-reactive	Undetectable

PCR: polymerase-mediated chain reaction; F: female; M: male; HTLV: human T lymphotrophic virus.

state of Bahia (1.7%)[28]. A study carried out in communities located on the shores of Lake Tucuruí, also in the state of Pará, presented higher seroprevalence (4.7%)[23] than the present study, but there was no molecular confirmation of the infection.

The mean rates of HTLV-1 infection in the population vary generally from 1 to 15% in the endemic regions[29]. The Brazilian Ministry of Health[30] classified the regions with more than 5% of seropositivity as high prevalence; between 5 and 1% as medium prevalence; and less than 1% as low prevalence for HTLV-1. The observed prevalence of the HTLV-1 infection (1.4%) indicates that the state of Pará has a medium endemicity for this infection, according to the Brazilian Ministry of Health.

A linear increase in infection was observed from the 30-year age group, even considering that only 10% of individuals were over 65 years of age. The elevation of the anti-HTLV antibodies amount as the age increases may lead to late seroconversion of acquired infection at birth or throughout life[31,32]. This aspect justifies the continued investigation of the sons, daughters and sexual partners of infected people[23,33].

Some studies suggest that vertical transmission is more prevalent in females than in males[34,35]. On the contrary, a study in Japan concluded that HTLV-1 infection is more common in males until the age of 20 when the sexual transmission of men to women becomes more likely[36]. In Japan, after 10 years of observation, 60% of women were infected when the ICs were men. In contrast, only 0.1 to 1.0% of men were infected when the ICs were women[12]. These facts may justify the expressiveness found in the analyzed women, which was absent in men.

The investigation did not show a significant percentage difference between women and men with the virus. However, the higher frequency of infection in women is well reported in a study that observed the most effective viral transmission from men to women[37], drawing attention to the need to expand the sample studied in order to clarify this variable in the study population.

The history of receiving a blood transfusion showed no association with the infection. Since the establishment of the Ministry of Health's Ordinance No. 1,376[38], blood banks were more taken care of in Brazil, with the establishment of serological screening tests in all units of blood collected, including the performance of high sensibility techniques, which reduced transmissions via this route[33].

Although studies have shown that the HTLV infection is associated with low levels of schooling,[28] this fact was not observed in the present study. Health education measures carried out in conjunction with this study provided information to many people, clarifying information about the viral infection, its forms of transmission and its associated diseases, since misinformation may promote greater neglected and remiss transmission of the virus.

Infection was associated with low family income, differing from[28] and in agreement with[23] with other research. A study carried out at a referral center in Belém stated that low purchasing power affects access to basic health, especially in the case of sexually transmitted infections. Many of these individuals live on the outskirts of the city and only have access to public health plans, which do not always attend to their needs[16].

Considering that approximately 90% of carriers are asymptomatic, and their most known and studied complications occur in about 5% of infected people, infection is traditionally related to low morbidity[30]. Despite this, HTLV attacks infected people in various ways, many of which are still unclear. A variety of symptoms and diagnoses can be found among individuals with HTLV-1. It is good to reinforce that individuals infected with HTLV present several clinical manifestations that are not associated with HAM/TSP or ATL, such as uveitis, arthropathy, HTLV-1 associated hyperactive bladder, among others. Even with a small sample of individuals infected with HTLV-1, this investigation showed clinical involvement associated with the infection, but a third of the investigated people with the infection did not know about it.

It was difficult to find people with the symptoms, since many of them were worried and/or disinterested in knowing the result of their examination, perhaps due to fear or some other unknown reason, making it impossible to discover and control new cases of the infection. In addition to the factors related to infected individuals, many health professionals are unaware of HTLV infection, since sometimes it is not discussed in their undergraduate classes and/or because they do not look for information about it. This fact is of extreme importance in order to make an adequate clinical evaluation and a differential diagnosis of infected individuals, since many of them may not be receiving adequate treatment for their diseases.

Some degenerative diseases, such as HAM/TSP, may confound individuals' diagnoses, since symptomatology is not always present or may not be very characteristic of HTLV infection. Updating professionals could provide better insight to help them diagnose the disease, and could provide alternatives to better treatment of the disease. Many already seemingly defined aspects of virus transmission and morbidity in individuals, families and populations have been scarcely explored, seeming as if the subject of epidemiology and the collective health problem have already been exhausted.

From investigation into family transmission of the virus, the importance of studying this variable was observed, since, with the discovery of a new person infected with HTLV, one also finds the "thread" of intrafamilial transmission of the infection and, from there, can initiate an investigation that demonstrates the transmission of the infection in most families, if not all of them, as in the present study.

In the absence of collective health programs aimed at controlling the spread of the virus, looking for cases in families may be important because of its high yield. In this case, the importance of this information for the carriers and their relatives is highlighted, since knowledge can prevent the virus from spreading in the family, especially through natural breastfeeding and sexual intercourse[24].

CONCLUSION

This study demonstrated a moderate prevalence and intrafamilial spread of HTLV infection in adult individuals in the metropolitan area of Belém. This infection was associated

with an increase in age, especially in women, and among low-income individuals. The predominance of HTLV-1 infection demonstrated negligence in the early diagnosis of debilitating diseases associated with this viral infection.

CONTRIBUTIONS

ICS, BTP, AFSN and MSS drafted the manuscript, participated in the analysis and interpretation of the data and helped performed the statistical analysis. JSC, CCSC, LSC, LSCF, MNSAV, DAS, JRF, YCVS, MWLA, MSB, LDN, LSV, AFSN and MSS participated in data collection, biological sample collection, serological and molecular analysis and helped to draft the manuscript. JSRC, CAC, AFSN and MSS critically reviewed the intellectual content and final version of the manuscript, and provided suggestions. All authors read and approved the final draft of the manuscript.

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