

WOMENS SEXUAL HEALTH

Human T-Lymphotropic Virus-1—Associated Myelopathy/Tropical Spastic Paraparesis Is Associated With Sexual Dysfunction in Infected Women of Reproductive Age

Adenilda Lima Lopes Martins, MD, PhD,^{1,2} Maria Fernanda Rios Grassi, MD, PhD,^{2,3} Alisson de Aquino Firmino, MSc,² Jean Paulo Lacerda Araujo, UGS,² Taiane Silva Paixao, UGS,² Bernardo Galvão-Castro, MD, PhD,^{2,3} and Ney Boa-Sorte, MD, PhD²

ABSTRACT

Introduction: Human T-lymphotropic virus (HTLV)-1—associated myelopathy/tropical spastic paraparesis (HAM/TSP) is a neurological disorder that mostly affects women. This disease is characterized by a progressive loss of motor function and disruptions in sensory function in the lower limbs. HTLV-1 is also associated with isolated neurologic dysfunctions, overactive bladder, and erectile dysfunction. The occurrence of sexual dysfunction in HTLV-1—infected women remain unclear.

Aim: To investigate associations between HTLV-1 infection and sexual dysfunction in both asymptomatic infected women and those diagnosed with HAM/TSP compared with uninfected women.

Methods: HTLV-1—infected and uninfected women were assessed for sexual dysfunction using the Female Sexual Function Index instrument. Sexual dysfunction was considered if global Female Sexual Function Index scores were <26.5. Crude and adjusted prevalence ratios (PR) with 95% CI were calculated to identify associations between sexual dysfunction (outcome) and HTLV infection status—asymptomatic or HAM/TSP (main exposure), compared with uninfected women, and adjusted by sociodemographic and/or clinical characteristics (covariables).

Results: HTLV-1—infected women (n = 72; 57 asymptomatic; 15 HAM/TSP) and HTLV-1 uninfected women (n = 49) were evaluated. The overall sexual dysfunction prevalence was 53.7% (65/121), which was higher in the HAM/TSP group (80.0%; adjusted PR 1.89; 95% CI 1.23–2.90) when compared with non-infected individuals (44.9%). Sexual dysfunction was found in 54.4% of the HTLV-1—infected asymptomatic women (PR 1.21; 95% CI 0.82–1.79). Sexual dysfunction was associated with income lower than 1 minimal wage (~US \$300, October 2017) and number of previous birthday.

Conclusion: The obtained results indicate that sexual dysfunction is associated with HAM/TSP in women infected with HTLV-1 of reproductive age. **Lima Lopes Martins A, Rios Grassi MF, de Aquino Firmino A, et al. Human T-Lymphotropic Virus-1—Associated Myelopathy/Tropical Spastic Paraparesis Is Associated With Sexual Dysfunction in Infected Women of Reproductive Age. Sex Med 2018;XX:XXX-XXX.**

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¹Universidade Estadual de Feira de Santana, Feira de Santana, Brazil;

²Centro Integrativo e Interdisciplinar de Centro Integrativo e Interdisciplinar para Atendimento de Portadores do Vírus Linfotrópico de Células T Humanas (HTLV), Escola Bahiana de Medicina e Saúde Pública, Salvador, Brazil;

³Laboratório Avançado de Saúde Pública, Instituto de Pesquisas Gonçalo Moniz, Fundação Oswaldo Cruz, Salvador, Brazil

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INTRODUCTION

Human T-cell lymphotropic virus (HTLV)-1 infects around 5–10 million individuals worldwide, mainly in Japan, Central Africa, Melanesia, the Caribbean, and South America.¹ The city of Salvador, located in northeastern Brazil, has the highest prevalence in the country.² A population-based study demonstrated that 1.8% of this city's population is infected, with the prevalence of infection in people aged 50 years or older reached 6.3% and 9.0% in men and women, respectively.³

The main forms of HTLV-1 transmission are parenteral, breast-feeding, and sexual. In the city of Salvador, HTLV-1 transmission occurs predominantly through sexual intercourse.⁴ An investigation conducted in HTLV-1–positive couples indicated a greater efficiency in virus transmission from men to women, which was estimated to represent a 61% higher risk for women over the 10-year study period.⁵

The diseases classically associated with HTLV-1 are adult T-cell leukemia/lymphoma,⁶ HTLV-1–associated myelopathy/tropical spastic paraparesis (HAM/TSP),^{7,8} HTLV-1–associated uveitis,⁹ and infective dermatitis in children.¹⁰ HTLV-1–infected individuals may present isolated neurologic dysfunction, such as gait impairment, overactive bladder, and erectile dysfunction.^{11,12} HAM/TSP is characterized by an inflammatory process and demyelination of the spinal cord, mainly around the thoracic level, leading to sensorial and/or motor alterations. HAM/TSP patients often report weakness in the lower limbs, paresthesia, gait disorders, back pain, constipation, and urinary disorders. This disease is more prevalent in women in the fourth decade of life.¹³ In addition, HTLV-1 infection has also been associated with what is referred to as “dry syndrome,” which can arise from manifestations including xerosis, xerostomia, and xerophthalmia.^{11,14} However, whether HTLV-1 represents the causal agent underlying dryness in the vaginal mucosa and/or sexual dysfunction in women has not been elucidated.

Sexual dysfunction is defined as changes in the organic and/or physiological components of normal sexual response, including decreased sexual desire and arousal, inhibition of orgasm, and dyspareunia.¹⁵ The origin of sexual dysfunction is multifactorial and can be associated with a broad spectrum of factors. The use of medications, such as beta-blockers, antidepressants, anticholinergics, and central nervous system depressant drugs,¹⁶ as well as chronic systemic diseases, including rheumatoid arthritis,¹⁷ chronic kidney disease,¹⁸ and Sjogren syndrome,¹⁹ have been associated with sexual dysfunction. In addition, diseases affecting central system functioning, such as spinal cord injury²⁰ and multiple sclerosis,^{21–23} are often associated with sexual dysfunction. In this context, HTLV-1–induced neurological changes, particularly spinal cord demyelination, could plausibly result in alterations in both vaginal mucosal lubrication and female sexual function.

The present study aimed to investigate associations between HTLV-1 infection and sexual dysfunction in both asymptomatic infected women, as well as those diagnosed with HAM/TSP compared with uninfected women.

METHODS

Study Design and Place of Study

The outcome variable of the present cross-sectional controlled study was sexual dysfunction in women, and the main exposure of interest was HTLV infection *status*, categorized as follows: (i) absence of infection (ie, not exposed); (ii) asymptomatic

HTLV-1–infected women; and (iii) women diagnosed with HAM/TSP. This study was conducted at the Integrated and Multidisciplinary HTLV Center (CHTLV), located in Salvador, Brazil, from August 2014 to March 2016. The CHTLV possesses a multidisciplinary team that provides comprehensive care to infected individuals and their families through the Brazilian Unified Health System (Sistema Único de Saúde).

Subjects

HTLV-1–infected women were selected by convenience sampling. They were sequentially included at the time of their scheduled appointments at the CHTLV. Uninfected group members were selected from women who accompanied patients during medical consultations, consisting of patient relatives or unrelated individuals. Inclusion criteria consisted of age ranging from 20 to 50 years. The exclusion criteria consisted of: surgery of the ovaries/uterus or vagina that affected sexual function; radiation therapy for cancer; other conditions/treatments that are known to interfere with hormone production; antidepressant and/or sexual dysfunction–associated medication use; menopause; and no reported sexual activity in the past 4 weeks.

The sample size for HTLV-1–asymptomatic group was done based on an estimated prevalence of sexual dysfunction of 30% for HTLV-1–uninfected women,²⁴ with an estimated prevalence ratio (PR) of 2.0 among HTLV-1–infected women and those uninfected. Adopting an alpha error of 5% and power of 80% it was determined to obtain 49 women in each group. For women with HAM/TSP diagnosis, the sample size calculation was performed estimating a sexual dysfunction prevalence of 80%, based on studies in women diagnosed with multiple sclerosis.²² Considering a ratio between uninfected women and HAM/TSP of 3:1, a minimum sample size of 12 patients was obtained for the HAM/TSP group. Positive enzyme-linked immunosorbent assay and Western blot confirmed HTLV-1 infection. Infected women were considered asymptomatic if they had no neurological symptoms and presented an Expanded Disability Status Scale (EDSS) score ≤ 1 .²⁵ A diagnosis of HAM/TSP was established using previously defined criteria²⁶ and EDSS score > 2 . Women from the uninfected group were tested negative for HTLV-1 serology. All study participants signed a written term of informed consent, and this study received approval by the institutional research board of the Bahiana School of Medicine and Public Health.

Data Collection

A specific questionnaire was drawn up to collect sociodemographic data and medical history (age, self-reported skin color, marital status, educational level, income, number of previous births, number of lifetime sexual partners, age of current partner, and existing medical conditions, including systemic arterial hypertension, urinary incontinence, intestinal constipation, and diabetes mellitus). The Female Sexual Function Index (FSFI)²⁷ was used for sexual dysfunction assessment, which evaluates

Table 1. Sociodemographic and clinical characteristics of 121 women evaluated at Integrated and Multidisciplinary Human T-Cell Lymphotropic Virus Center in Salvador, Brazil

Variable	Uninfected, n = 49	HTLV-1-infected women		P value
		Asymptomatic, n = 57	HAM/TSP, n = 15	
Age, y*	35.6 ± 7.9	34.2 ± 7.2	41.1 ± 6.7	.007
Skin color, self-reported				.064 [†]
Black	25 (51.0)	30 (52.6)	05 (33.3)	
Brown	22 (45.8)	18 (31.6)	08 (53.3)	
White	02 (4.1)	09 (15.8)	01 (6.7)	
Yellow	—	—	01 (6.7)	
Educational level, y*	12.0 (8.0–12.0)	09 (5.0–12.0)	12 (8.0–14.0)	.064
Marital status				.095
Married/stable union	35 (71.4)	44 (77.2)	8 (53.3)	
Single	11 (22.5)	13 (22.8)	7 (46.7)	
Divorced/separated	03 (6.1)	—	—	
Income, MW*	2.0 (1.0–2.0)	1.0 (1.0–2.0)	02 (1.0–2.0)	.021
Partner age, y*	38.3 (9.8)	39.4 (9.5)	46.7 (4.9)	.033
No. of partners*	4.0 (2.0–7.0)	5.0 (3.0–12.0)	4.0 (3.0–7.0)	.401
No. of previous births*	2.0 (1.0–2.0)	1.0 (1.0–3.0)	2.0 (0.0–3.0)	.803
SAH				.365 [†]
Present	04 (8.2)	10 (17.5)	01 (7.1)	
Absent	45 (91.8)	47 (82.5)	13 (92.9)	
Urinary incontinence				<.001 [†]
Present	03 (6.1)	12 (21.0)	10 (71.4)	
Absent	46 (93.9)	45 (79.0)	04 (28.6)	
Intestinal constipation				<.001 [†]
Present	01 (2.0)	11 (19.3)	08 (57.1)	
Absent	48 (98.0)	46 (80.7)	6.0 (42.9)	
Diabetes mellitus				1.000 [†]
Present	03 (6.1)	03 (5.3)	—	
Absent	46 (93.9)	54 (94.7)	14 (100.0)	

Data represent number and (frequencies) unless otherwise noted.

HAM/TSP = human T-cell lymphotropic virus-1-associated myelopathy/tropical spastic paraparesis; HTLV = human T-cell lymphotropic virus; MW = minimum wage (~US\$300, October 2017); SAH = systemic arterial hypertension.

*Values expressed as mean ± SD or medians (p25–p75).

[†]Fisher exact test.

the female sexual response in 6 domains consisting of questions pertaining to sexual activity in the previous 4 weeks: desire, arousal, lubrication, orgasm, satisfaction, and pain/discomfort. Sexual dysfunction was considered if global FSFI scores were <26.5.²⁷

Statistical Analysis

Quantitative variables were assessed for normal distribution using the Shapiro-Wilk test. Means (SD) were used when normal distributions were verified, while medians (p25–p75) were used in the case of non-normal distributions. Absolute and relative frequencies were described for categorical variables. Comparisons among sociodemographic and clinical characteristics were performed using the χ^2 test or Fisher exact test when indicated (categorical variables). Analysis of variance was performed using the Bonferroni post hoc test or non-parametric Kruskal-Wallis with Dunn-Bonferroni post-test when indicated (continuous

variables). Comparisons of global FSFI scores between groups were made using the non-parametric Mann-Whitney test. Crude (bivariate analysis) and adjusted (multivariate analysis) PR with 95% CI were calculated to identify associations among sexual dysfunction (outcome), HTLV infection (main exposure), and sociodemographic and/or clinical characteristics (covariables). Variables presenting a *P* value <.20 under bivariate analysis, as well as those of theoretical relevance, were selected for multivariate model. Poisson regression with robust error was used to estimate adjusted PRs. *P* values <.05 were considered statistically significant. All statistical analyses were performed using software (STATA, Version 13; StataCorp, College Station, TX, USA).

RESULTS

91 asymptomatic HTLV-1-infected women and 28 diagnosed with HAM/TSP were selected. Of these, 32 (16 in menopause,

Table 2. Comparisons of median (p25–p75) specific and overall Female Sexual Function Index domain scores, stratified according to infection status (uninfected, human T-cell lymphotropic virus-1 asymptomatic, and human T-cell lymphotropic virus-1-associated myelopathy/tropical spastic paraparesis) among the 121 women studied

Domain	Uninfected, n = 49	HTLV-1 Asymptomatic, n = 57	HAM/TSP, n = 15	P value	
				Uninfected vs HAM/TSP	Asymptomatic vs HAM/TSP
Desire	4.2 (3.0–4.8)	3.6 (3.0–4.8)	3.6 (2.4–4.8)	.060	.225
Arousal	4.2 (3.6–5.1)	4.2 (3.6–5.1)	4.2 (1.5–4.6)	.122	.137
Lubrication	4.8 (4.2–5.7)	4.8 (3.9–5.4)	4.2 (2.7–5.1)	.004	.022
Orgasm	4.4 (3.6–5.2)	4.4 (3.2–5.2)	3.2 (1.2–4.4)	.026	.029
Satisfaction	5.2 (3.6–6.0)	4.8 (3.6–5.6)	4.4 (2.4–5.2)	.017	.041
Pain/discomfort	4.4 (3.2–5.6)	4.8 (3.2–6.0)	4.4 (4.4–5.6)	.257	.395
Overall	27.6 (23.0–30.6)	26.3 (22.4–30.0)	25.0 (18.3–25.8)	.010	.029

P values pertaining to group-to-group analysis (post hoc tests).

HAM/TSP = human T-cell lymphotropic virus-1-associated myelopathy/tropical spastic paraparesis; HTLV = human T-cell lymphotropic virus.

11 with no reported sexual activity in the previous 4 weeks, 2 who were pregnant, and 3 who were on antidepressants) and 13 (10 menopausal, 2 with no reported sexual activity in the prior 4 weeks, and 1 taking antidepressants) were excluded, respectively. Of the 61 uninfected women, 12 were excluded due to menopause (n = 6), no sexual activity in the previous 4 weeks (n = 4), and pregnancy (n = 2). The final sample comprised 57 asymptomatic HTLV-1-infected women, 15 diagnosed with HAM/TSP and 49 uninfected women. Sociodemographic and clinical characteristics are presented in Table 1. Most women with HAM/TSP were self-classified as brown (P = .064); asymptomatic infected women had lower educational levels (P = .064) and income (P = .021) compared to uninfected individuals. Women with HAM/TSP had older partners (P = .033) and a higher frequency of urinary incontinence and intestinal constipation (P < .001). HAM/TSP patients presented a median EDSS score (p25–p75) of 4.0 (2.0–6.0). Among the HTLV-1-infected asymptomatic women, all had an EDSS score of 0.

The overall prevalence of sexual dysfunction was 53.7% (65/121), which was higher in the HAM/TSP group (80.0%; PR 1.78; 95% CI 1.19–2.66) in comparison to uninfected group (44.9%). Sexual dysfunction was found in 54.4% of the HTLV-1-infected asymptomatic women (PR 1.21; 95% CI 0.82–1.79).

Statistical significance was observed with respect to comparisons among groups concerning both individual domain scores and overall FSFI score (Table 2). A significant difference was seen between the groups (P = .032) with respect to the lubrication domain, with HAM/TSP women presenting the lower scores compared to both asymptomatic women (Table 2) (P = .022) and uninfected groups (P = .004). Comparisons made among the 3 groups revealed no significant differences in the median scores obtained from the desire, excitement, orgasm, and pain domains. However, in group-to-group comparisons (post hoc tests), women with HAM/TSP presented lower scores in the

orgasm domain compared with asymptomatic (P = .029) and uninfected (P = .026) women. Regarding the satisfaction domain, uninfected (P = .017) and asymptomatic (P = .041) women presented higher scores than patients with HAM/TSP. Overall FSFI scores were also significantly lower among patients with HAM/TSP compared with both asymptomatic (P = .029) and uninfected (P = .010) women. No differences were observed when comparing the overall scores of asymptomatic and uninfected women (Table 2).

Under bivariate analysis, sexual dysfunction was associated with the following variables: income lower than 1 minimum wage (PR 1.40; 95% CI 1.00–1.95), number of previous births (PR 1.95; 95% CI 1.07–3.56), and a HAM/TSP diagnosis (PR 1.78; 95% CI 1.19–2.66) (Table 3). Even after adjusting for income and number of previous births, HAM/TSP remained associated with sexual dysfunction (PR 1.89; 95% CI 1.23–2.90), as shown in Table 3.

DISCUSSION

The present results indicate that HAM/TSP is associated with sexual dysfunction in women infected with HTLV-1 of reproductive age, since this condition was more prevalent in these women when compared to the uninfected group. In addition, the prevalence of sexual dysfunction in HTLV-1-infected asymptomatic women was found to be similar to the uninfected group. Lower median scores in the FSFI domains of lubrication, orgasm, and satisfaction were seen in women with HAM/TSP compared to the other groups. To the best of our knowledge, this study represents the first attempt to establish an association between HTLV-1 infection and sexual dysfunction in women.

The present study identified sexual dysfunction in 80.0% of the women with HAM/TSP, 1.9 times the prevalence found in the uninfected group. 2 hypotheses could explain this finding. Firstly, sexual dysfunction could be secondary to the chronic and progressive inflammatory process induced by HTLV-1, as

Table 3. Crude and adjusted prevalence ratios of sociodemographic and clinical factors, considering the total sample as well as women classified with sexual dysfunction

Variable	Total N (%)	SD N (%)	Crude PR (95% CI)	Adjusted PR (95% CI)
HTLV-1 status				
Absent	49 (40.5)	22 (44.9)	1.00	1.00
Asymptomatic	57 (47.1)	31 (54.4)	1.21 (0.82–1.79)	1.08 (0.75–1.57)
HAM/TSP	15 (12.4)	12 (80.0)	1.78 (1.19–2.66)	1.89 (1.23–2.90)
Age, y				
20–34	54 (44.6)	27 (50.0)	1.00	
35–50	67 (55.4)	38 (56.7)	1.13 (0.81–1.59)	
Skin color, self-reported				
White/brown	61 (50.4)	34 (55.7)	1.00	
Black	60 (49.6)	31 (51.7)	0.93 (0.66–1.29)	
Income, MW				
>1	66 (54.6)	30 (45.4)	1.00	1.00
≤1	55 (45.4)	35 (63.6)	1.40 (1.00–1.95)	1.43 (1.04–1.98)
Educational level				
≥9 y	77 (63.6)	37 (48.0)	1.00	
≤8 y	44 (36.4)	28 (63.6)	1.32 (0.96–1.83)	
Marital status				
Married/stable union	87 (73.7)	49 (56.3)	1.25 (0.81–1.92)	
Other conditions	31 (26.3)	14 (45.2)	1.00	
Previous births				
With children	26 (21.5)	08 (30.8)		1.00
No children	95 (78.5)	57 (60.0)	1.95 (1.07–3.56)	2.04 (1.17–3.55)
No. partners				
≤2	27 (22.7)	16 (59.3)	1.00	
≥3	92 (77.3)	47 (51.1)	0.86 (0.59–1.25)	
Age of partner, y				
≤39	55 (51.9)	27 (49.1)	1.00	
≥40	51 (48.1)	27 (52.9)	1.08 (0.74–1.57)	
SAH				
Yes	15 (12.5)	7 (46.7)	0.86 (0.48–1.52)	
No	105 (87.5)	57 (54.3)	1.00	
Urinary incontinence				
Yes	25 (20.8)	17 (68.0)	1.37 (0.98–1.93)	
No	95 (79.2)	47 (49.5)	1.00	
Intestinal constipation				
Yes	20 (16.7)	14 (70.0)	1.40 (0.99–1.98)	
No	100 (83.3)	50 (50.0)	1.00	
Diabetes mellitus				
Yes	6 (5.0)	4 (66.7)	1.27 (0.70–2.30)	
No	114 (95.0)	60 (52.6)	1.00	

HAM/TSP = human T-cell lymphotropic virus-1-associated myelopathy/tropical spastic paraparesis; HTLV = human T-cell lymphotropic virus; MW = minimal wage (~US\$300, October 2017); PR = prevalence ratio; SAH = systemic arterial hypertension.

evidenced by the infiltration of lymphocytes, monocytes, and glial-mesenchymal markers in the white matter.^{28,29} This likely contributes to reduced blood supply to nervous tissue, as well as decreased conduction of the nervous stimulus. Indeed, the nervous system acts directly on sexual function through stimuli in the genitalia, controlled by the parasympathetic and sympathetic systems (pudendal, pelvic, and hypogastric nerves).²⁰ These stimuli increase local blood supply, promoting the

engorgement and protrusion of the clitoris and eventually triggering congestion and neuromuscular tension.³⁰ Corroborating the secondary nature of sexual dysfunction to a progressive inflammatory process affecting the spinal cord, a high prevalence of sexual dysfunction (over 50%) has also been described in women with multiple sclerosis, a demyelinating disease with clinical neuropathic characteristics similar to those evidenced in HAM/TSP.^{21–23}

Secondly, sexual dysfunction in women diagnosed with HAM/TSP might also be due to the chronic nature of this disease, which negatively affects physical and emotional health, especially among young people,³¹ leading to a worsening in quality of life.³² In addition, chronic disease has also been shown to result in negative experiences in sexual relations, which can affect the psycho-emotional aspects associated with desire.³³ In fact, another study reporting on the prevalence of sexual dysfunction in Brazilian women with chronic illness, in an age group similar to that of the present study, which also used the FSFI measurement instrument, found a similar prevalence to that described herein. In women aged 36 to 63 years with rheumatoid arthritis, the reported prevalence of sexual dysfunction was 79.6%.³⁴ Moreover, a high prevalence of sexual dysfunction has also been described in women with chronic diseases from culturally diverse countries (eg, 84.0% in 1,472 European and Argentinean women undergoing hemodialysis due to chronic kidney disease¹⁸; 82.5% in 137 women with multiple sclerosis in Poland²¹; and 80.4% of Turkish women with Sjogren syndrome).³⁵

Interestingly, the present study found a higher prevalence of sexual dysfunction in uninfected group than what was previously described in other Brazilian studies carried out in HTLV-1—uninfected women of similar age. This finding becomes even more relevant when considering that women with predisposing sexual dysfunction conditions, such as menopause, antidepressants, and sexual dysfunction—associated medications, were excluded. It is possible that the observed variation in prevalence among uninfected populations could be due to different clinical and sociodemographic characteristics, variability among measurement instruments, and/or specific criteria used to define sexual dysfunction. Using the Female Sexual Quotient, a comprehensive study on sexuality conducted in 7 Brazilian capitals found a prevalence of 34.6% regarding sexual dysfunction.²⁴ Other Brazilian studies employing the FSFI described an overall prevalence ranging from 21.9% to 37.8% in women,^{36–38} lower than what was found in the present study. Recently, a systematic review evaluating the prevalence of sexual dysfunction in Brazilian women reported a range varying from 13.3% to 79.3%; however, several articles included in this revision focused on women with severe chronic disease, or others who were pregnant or in menopause, ie, all factors that can contribute to sexual dysfunction.³⁹

In addition to HAM/TSP, we also observed associations between sexual dysfunction and number of previous births, as well as low income. The prevalence of sexual dysfunction in women with children was 3-fold greater than those who were childless. However, another study has reported contradictory results.⁴⁰ Concerning income, herein we found that sexual dysfunction was 1.5 times more likely in women with income lower than 1 minimum wage. A large population-based study carried out in the United States indicated that stress-inducing events of a social nature can negatively affect sexual function,³³ which was similar to what was found by Neal et al⁴¹ in 2015 in the same country. A study in Brazil

found that although low-income women reported worse conditions regarding health, work, and leisure, those with higher income, who worked in a highly competitive environment and handled many family obligations, had a higher prevalence of sexual dysfunction.³⁷ The lack of conclusive evidence regarding associations between sexual dysfunction and number of previous births, as well as income level, reinforce the need to more comprehensively evaluate the role of social factors with regard to sexual dysfunction.

A limitation of the present study was the small number of HTLV-1—infected women with HAM/TSP diagnosis. However, HAM/TSP was consistently associated with the presence of sexual dysfunction, even after adjustment for confounders. Another limitation of this study was with respect to the contribution of psychosocial and emotional conditions in sexual dysfunction. Although women with a clinical diagnosis of depression and/or taking antidepressants were excluded, we did not perform a detailed evaluation of psychosocial profile, especially regarding anxiety. In addition, the presence of sexual dysfunction in women's partners, which is a recognized risk factor of sexual dysfunction,⁴² was not evaluated. This becomes particularly relevant when considering the probability that woman with HAM/TSP may also have partners with the same disease.

CONCLUSION

The results obtained herein indicate that an association exists between sexual dysfunction and women with HAM/TSP who are infected with HTLV-1. Future studies should be conducted to further investigate the role of psychosocial conditions and biological mechanisms involved in this association.

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Corresponding Author: Adenilda Lima Lopes Martins, MD, PhD, Centro Integrativo e Interdisciplinar para Atendimento de Portadores do Vírus Linfotrópico de Células T Humanas (HTLV), Escola Bahiana de Medicina e Saúde Pública, Av. D João VI, 275 Brotas Salvador - Bahia- Brasil. CEP:40290-000; E-mail: adenildamartins@hotmail.com

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STATEMENT OF AUTHORSHIP

Category 1

(a) Conception and Design

Adenilda Lima Lopes Martins; Ney Boa-Sorte; Maria Fernanda Rios Grassi; Bernardo Galvão-Castro

(b) Acquisition of Data

Adenilda Lima Lopes Martins; Alisson Aquino Firmino; Taiane Silva Paixao; Jean Paulo Lacerda Araujo; Ney Boa-Sorte; Maria Fernanda Rios Grassi; Bernardo Galvão-Castro

(c) Analysis and Interpretation of Data

Adenilda Lima Lopes Martins; Maria Fernanda Rios Grassi; Alisson Aquino Firmino; Taiane Silva Paixao; Jean Paulo Lacerda Araujo; Ney Boa-Sorte; Bernardo Galvão-Castro

Category 2**(a) Drafting the Article**

Adenilda Lima Lopes Martins; Ney Boa-Sorte; Maria Fernanda Rios Grassi; Bernardo Galvão-Castro

(b) Revising It for Intellectual Content

Adenilda Lima Lopes Martins; Ney Boa-Sorte; Maria Fernanda Rios Grassi; Bernardo Galvão-Castro

Category 3**(a) Final Approval of the Completed Article**

Adenilda Lima Lopes Martins; Maria Fernanda Rios Grassi; Alisson Aquino Firmino; Taiane Silva Paixao; Jean Paulo Lacerda Araujo; Bernardo Galvão-Castro; Ney Boa-Sorte

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