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ORIGINAL ARTICLE

Epidemiological aspects of American and visceral cutaneous leishmaniasis in the city of Cametá, Pará, Amazon

Aspectos epidemiológicos da leishmaniose tegumentar americana e visceral na cidade de Cametá, Pará, Amazônia

Aspectos epidemiológicos de la leishmaniasis cutánea americana y visceral en la ciudad de Cametá, Pará, Amazonas

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ABSTRACT

Background and objectives: leishmaniases are anthropozoonosis considered a major public health problem in tropical regions and endemic in some areas of constant expansion. This study aimed to assess the main epidemiological aspects of American tegumentary leishmaniasis (ATL) and visceral leishmaniasis (VL) in the municipality of Cametá, in the state of Pará, from 2007 to 2017. **Methods:** this is a descriptive-exploratory analysis, of time series, with data collected in the Department of Epidemiological Surveillance of the Department of Sanitary Surveillance of Cametá. Statistical calculations were performed, and, for the coefficient of incidence of ATL and VL, the standard formula was used to obtain the indicator. **Results:** a total of 94 and 294 cases of ATL and VL were reported, with the highest incidence rate in 2008. The disease affected all established age groups, with high frequency in children under ten years of age for VL (n=174), and between 20 and 30 years of age, for ATL (n=71). The disease was more prevalent in males (ATL (89.4%) and VL (58.2%)), because men are more related to economic activities. **Conclusion:** considering the high number of rural cases, it is noteworthy that reporting in urban areas is also worrisome, in addition to the livelihood of local families, because it has made them vulnerable to the disease. Furthermore, there is concern about the possible expansion and change in the pattern of ATL in the municipality. The Municipal Department as well as the epidemiological surveillance must pay attention to promote investments and campaigns to combat and treat this important disease.

Keywords: *Epidemiology. Leishmania. Zoonosis. Amazon.*

RESUMO

Justificativa e objetivos: as leishmanioses são antropozoonoses consideradas um grande problema para a saúde pública em regiões tropicais e endêmicas em algumas áreas de constante expansão. Este estudo teve como

objetivo avaliar os principais aspectos epidemiológicos da leishmaniose tegumentar americana (LTA) e leishmaniose visceral (LV) no município de Cametá, no estado do Pará, no período de 2007 a 2017. **Métodos:** trata-se de uma análise descritiva-exploratória, de série temporal, com dados coletados no Departamento de Vigilância Epidemiológica da Secretaria de Vigilância Sanitária de Cametá. Realizaram-se os cálculos estatísticos, e, para o coeficiente de incidência de LTA e LV, utilizou-se a fórmula padrão para a obtenção do indicador. **Resultados:** foram notificados 94 e 294 casos de LTA e LV, com maior taxa de incidência em 2008. A doença atingiu todas as faixas etárias estabelecidas, com alta frequência nos menores de dez anos para LV (n=174), e, entre 20 e 30 anos de idade, para LTA (n=71). A doença foi mais prevalente no sexo masculino (LTA (89,4%) e LV (58,2%)), em virtude dos homens estarem mais relacionados com as atividades econômicas. **Conclusão:** em vista do alto número de casos rurais, ressalta-se que a notificação em área urbana também é preocupante, além dos meios de subsistência das famílias locais, pois vem tornando-as vulneráveis para o adoecimento. Ademais, há a preocupação com a possível expansão e mudança no padrão da LTA no município. A Secretaria Municipal, bem como de vigilância epidemiológica, deve atentar-se a promover investimentos e campanhas de combate e tratamento deste importante agravo.

Descritores: *Epidemiologia. Leishmania. Zoonose. Amazônia.*

RESUMEN

Justificación y objetivos: las leishmaniasis son antropozoonosis consideradas un importante problema de salud pública en las regiones tropicales y endémicas en algunas zonas de constante expansión. Este estudio tuvo como objetivo evaluar los principales aspectos epidemiológicos de la leishmaniasis tegumentaria americana (LTA) y la leishmaniasis visceral (LV) en el municipio de Cametá, en el estado de Pará, de 2007 a 2017. **Métodos:** se trata de un análisis descriptivo-exploratorio, de serie temporal, con datos recolectados en el Departamento de Vigilancia Epidemiológica de la Secretaría de Vigilancia Sanitaria de Cametá. Se realizaron cálculos estadísticos y, para el coeficiente de incidencia de LCA y LV, se utilizó la fórmula estándar para obtener el indicador. **Resultados:** se reportaron 94 y 294 casos de LTA y LV, con la mayor tasa de incidencia en 2008. La enfermedad afectó a todos los grupos de edad establecidos, con alta frecuencia en menores de diez años para LV (n=174), y entre 20 y 30 años. años de edad, para LTA (n=71). La enfermedad fue más prevalente en el sexo masculino (LTA (89,4%) y VL (58,2%)), debido a que los hombres están más relacionados con actividades económicas. **Conclusión:** dado el alto número de casos rurales, cabe señalar que la notificación en las zonas urbanas también es motivo de preocupación, además de los medios de subsistencia de las familias locales, ya que las ha vuelto vulnerables a la enfermedad. Además, existe preocupación por la posible expansión y cambio en el patrón de LTA en el municipio. La Secretaría Municipal, así como la de vigilancia epidemiológica, debe prestar atención a promover inversiones y campañas para combatir y tratar este importante problema.

Palabras clave: *Epidemiología. Leishmania. Zoonosis. Amazonas.*

INTRODUCTION

Leishmaniasis are anthropozoonosis considered a major public health concern in tropical regions.[1] They represent a set of diseases with important clinical spectra and epidemiological diversity, where, according to the Pan American Health Organization, it is estimated that 350 million people are exposed to risk, with records of approximately two million new cases per year in different forms.[2] Visceral (VL) and American tegumentary leishmaniasis (ATL) are classified as neglected diseases, caused by more than 20 species of leishmania.[3]

In the Amazon, there are two types of epidemic leishmaniasis: (cutaneous) ATL and (kala-azar) VL. ATL is characterized by cutaneous wounds that are located more frequently on uncovered parts of the body. In the future, wounds may appear on the mucous membranes of the mouth, nose and throat. This form of infection is known as "*ferida brava*" (in Portuguese), of an occupational nature, with reflections in the economic and social field, as it is directly related to rural activities in enzootic regions.[4] On the other hand, VL is a systemic disease, since it affects several internal organs, which is characterized by irregular episodes of fever, spleen and liver swelling, in addition to substantial weight loss and anemia (severe condition), responsible for due to high mortality rates in underdeveloped countries, marginalized populations and contributing to perpetuate cycles of poverty and social exclusion.[5]

Transmission occurs through the bite of infected female sandflies, belonging to the genus *Lutzomyia*, with emphasis on the species *Lutzomyia longipalpis* (*Lu. longipalpis*), the main species involved in the transmission of etiological agent *Leishmania chagasi*, which causes VL; and *Leishmania amazonenses, Leishmania guyanensis, Leishmania braziliensis*, main species causing ATL in Brazil.[6,7] The transmitting insects belong to the order *Diptera*, suborder *Nematocera*, family *Psychodidae* and subfamily *Phlebotominae*.[8] Sandflies, vectors of leishmaniasis, are also popularly known in some regions as "*mosquito palha*", "*birigui*", "*flebótomo*", "*ligerinho*", among others.[9]

In recent decades, epidemiological analyzes suggest changes in the disease transmission pattern, with high endemicity in practically deforested rural areas, and

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in peri-urban regions.[10] The infection dynamics differs between the places of occurrence due to variables such as vectors, parasites, ecosystems, in addition to social processes of production and land use.[10]

Although the epidemiological and landscape characteristics of these places are similar, they constitute areas where the forms of space occupation and land use interfere with socioecological processes, which result in instability in ATL incidence.[11]

VL diagnosis can be performed using immunological and parasitological techniques, such as the detection of anti-Leishmania antibodies, indirect immunofluorescence reaction and rapid immunochromatographic test.[12] In 1913, the first necropsy case of a patient born in Boa Esperança-MG was described. Since then, it has been reported in several Brazilian municipalities, showing differences in transmission pattern, initially at a higher rate in wild and rural environments and more recently reported in urban centers.[13]

In 2016, Brazil registered 12.690 cases of VL, the highest rate among American countries, followed by Colombia (10.966), Nicaragua (5.423) and Peru (7.271), together accounting for 74.3% of total records.[2] The incidence rate in the following year decreased, with an incidence of 1.98 cases per 100.000 inhabitants.[14] In the Brazilian Amazon, between 1975 and 2015, there was a great disease expansion and incidence. According to the Unified Health System Department of Informatics System (DATASUS - *Departamento de Informática do Sistema Único de Saúde*), in the same period, in the state of Pará, 3.882 cases of ATL were registered in the Notified Diseases Information System (SINAN - *Sistema de Informação de Agravos de Notificação*).[14]

Considering the importance of ATL and VL in the Amazonian context, in Cametá-PA, whose municipality is in a constant process of expansion, it becomes relevant to better understand the dynamics of transmission of this parasitic infection, which is very present in the region. Thus, this study aimed to assess the main epidemiological aspects of ATL and VL in the municipality of Cametá, in the state of Pará, from 2007 to 2017, in order to verify the population's vulnerability aspects.

METHODS

The study carried out was of the descriptive-exploratory type, carried out through a survey of secondary data collected at the Department of Epidemiological Surveillance of the Department of Health Surveillance (DHS) of Cametá-PA. Data show the prevalence of human ATL and VL by year, sex, age group, area of residence and number of cases and the incidence coefficient, from 2007 to 2017.

The municipality of Cametá is located in the state of Pará, northern Brazil, with an estimated population of 140,814 inhabitants, and demographic density of 39.23 inhab./km^2, with an area of 3,081.367 Km^2.[16] The average local temperature is 26.9 °C, with a precipitation rate of 55 mm in dry months and 420 mm in rainy months.[16]

Statistical calculations were performed using Microsoft Office Excel 2019, to obtain the frequency in percentage (%), and for the incidence coefficient (I.C.) of ATL and VL, the standard formula for obtaining the indicator was used, the starting from the number of cases of leishmaniasis: I.C. = Number of new cases of leishmaniasis x 100,000 inhabitants/population.

All data officially cataloged in the DHS database of the Ministry of Health were included, with link: https://www.gov.br/saude/pt-br/composicao/svsa.

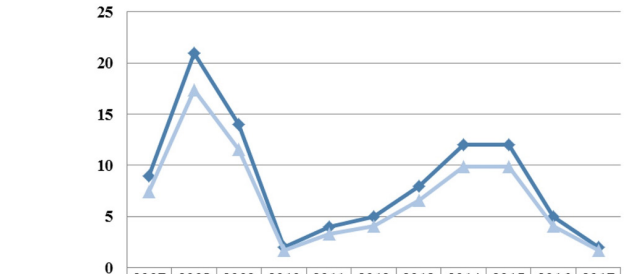
A survey was carried out in cartographic databases of the Brazilian Institute of Geography and Statistics (IBGE - *Instituto Brasileiro de Geografia e Estatística*) and Cartography of the Brazilian Amazon. For the spatial analysis technique, Google Earth Pro was used, which allows the visualization of real images captured by satellite, based on the Geocentric Reference System for the Americas (SIRGAS - *Sistema de Referência Geocêntrico para as Américas*) 2000.

Due to the use of freely accessible secondary data and without any identification of the research subjects, submission and approval by an ethics committee was not necessary, as defined by Resolution of the Brazilian National Health Council 510 of April 7, 2016: https://conselho.saude.gov.br/resolucoes/2016/Reso510.

RESULTS

American cutaneous leishmaniasis

During the study period, 94 cases of ATL were found, oscillating over the 11 years. There was a variation in the incidence rate, reaching a maximum peak in 2008, with a rate of 17.37 per 100.000 inhabitants, and a minimum in 2010 and 2017, with 1.65 per 100.000 inhabitants (Figure 1).



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
N° of cases	9	21	14	2	4	5	8	12	12	5	2
I. C.	7.4	17.4	11.6	1.7	3.3	4.1	6.6	9.9	9.9	4.1	1.7

Figure 1. Number of cases and incidence coefficient of American tegumentary leishmaniasis in the municipality of Cametá, Pará, from 2007 to 2017.
*Source: Notified Diseases Information System, Department of Health Surveillance of Cametá. *Number of cases; **I.C.- incidence coefficient.*

The disease affects all established age groups, with low frequency in children under five years of age, however, tending to increase progressively as age advances, with a higher frequency among individuals between 20 and 30 years of age, male, coming from rural space (Table 1).

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Table 1. Behavior of American tegumentary and visceral leishmaniasis in the municipality of Cametá-PA, between 2007 and 2017.

	ATL		VL	
Characteristic	**N° of cases**	**%**	**N° of cases**	**%**
Sex				
Male	84	89.4	171	58.2
Female	10	10.6	123	41.8
Age range				
<1	1	1.1	24	8.2
1-4	3	3.2	117	39.8
5-9	4	4.2	57	19.4
10-14	4	4.2	21	7.1
15-19	11	11.7	19	6.5
20-29	20	21.3	28	9.5
30 and +	51	54.3	28	9.5
Zone of residence				
Urban	22	25.9	22	19.5
Rural	63	74.1	63	80.5

Source: Department of Health Surveillance, Cametá, 2018.

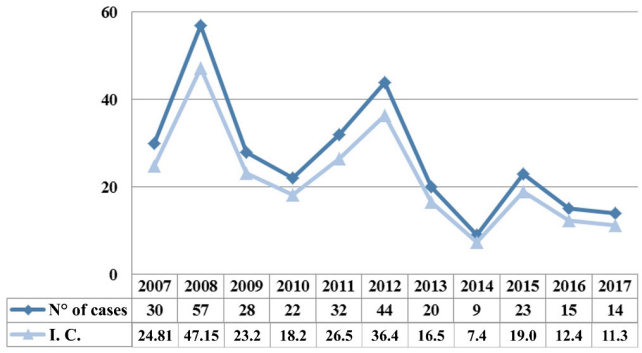
According to the survey, the largest reported cases of ATL were in the rural area, aged between 20 and 30 years. Santos et al.,[18] when carrying out an epidemiological study in the state of Alagoas, observed that 39% of cases were ATL, with a prevalence in people aged between 20 and 49 years, corroborating with those found in this research.

Figure 2 shows the five central districts (Castanhal, Bairro Novo, Primavera, Bom Jesus and São Raimundo) of the municipality as possible areas of vulnerability, which allows identifying probable points of urban leishmaniasis infections according to the epidemiological survey.

Visceral leishmaniasis

During the study period, 294 cases of VL were reported in the municipality of Cametá, with the highest occurrence between 2007 and 2012 (figure 3). The lethality rate in the period was 1.7% (five deaths), with higher and lower incidence records in 2008 and 2009, with 47.2 and 7.44 cases per 100.000 inhabitants, respectively.

Among the reported cases, there was a higher frequency in males (Table 1). As for the age group variable, the most affected by VL were children between 1 and 9 years old, with 39.8% of cases between 1 and 4 years old, which refers to greater vulnerability in this phase of life.



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
N° of cases	30	57	28	22	32	44	20	9	23	15	14
I. C.	24.81	47.15	23.2	18.2	26.5	36.4	16.5	7.4	19.0	12.4	11.3

Figure 3. Number of cases and coefficient of incidence of visceral leishmaniasis in the municipality of Cametá, Pará, from 2007 to 2017.
*Source: Notified Diseases Information System, Department of Health Surveillance of Cametá. *Number of cases; **I.C.- incidence coefficient.*

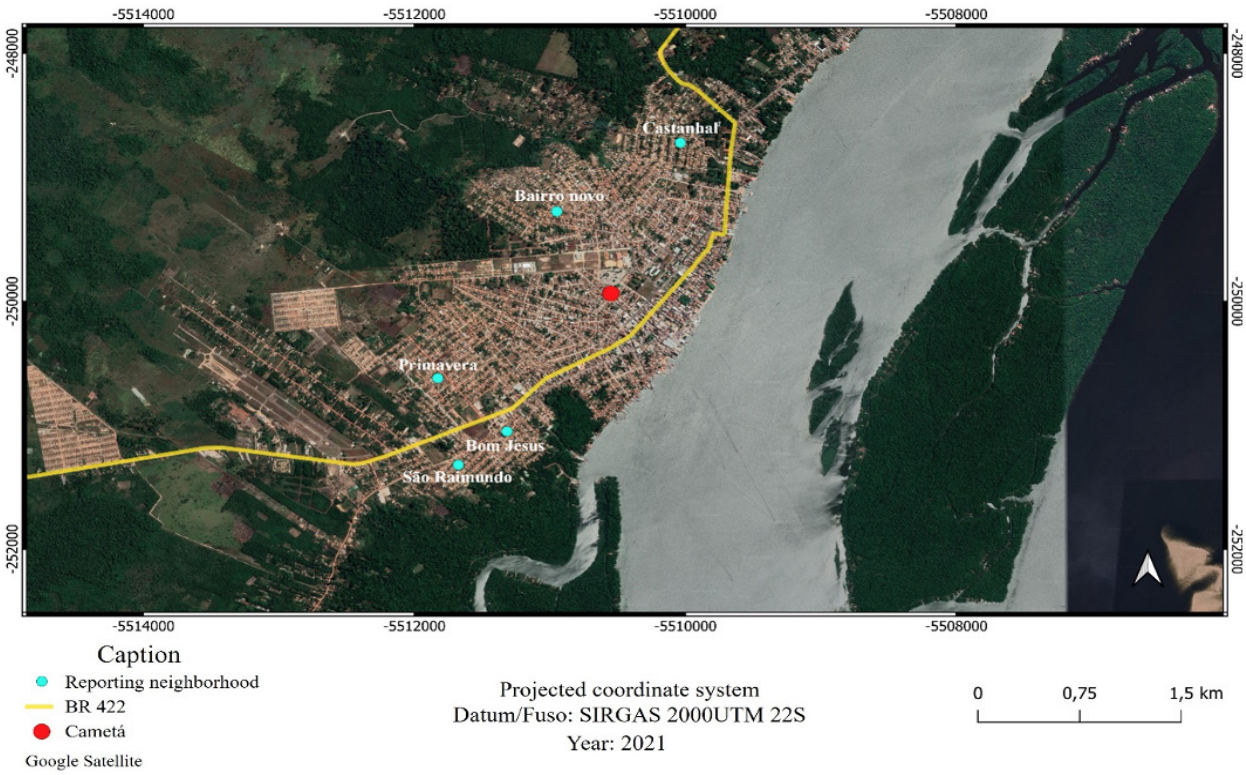


Figure 2. Probable areas of American tegumentary leishmaniasis infections in Cametá-PA.
Source: Department of Epidemiological Surveillance of the Department of Health Surveillance. Cametá and Google Earth, 2021

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DISCUSSION

During the study, a decline in the incidence rate of cases was observed. I.C. use (Figure 1) better assesses the risk of acquiring the disease in the locality.[16] Thus, according to I.C. the risk of acquiring the disease in 2017 was lower compared to previous years, as it presented a rate of 1.65 per 100.000 inhabitants, the same value recorded in 2010.

According to data from the Pan-American Health Organization,[19] Brazil recorded a total of 12,690 cases of leishmaniasis in 2016, a reduction of 34% compared to the previous year.

The highest number of cases was concentrated between 2008 and 2009, with 21 and 14 cases, respectively. In subsequent years, there was a decrease, but the curve remained stable, rising again in 2014 and 2015. It assumes that this high incidence is related to work activities carried out in regions, such as prospecting activities, agriculture, wood exploitation, agrarian settlements close to forest areas (large scale), deforestation for implementing pastures, in addition to the favorable climatic conditions for the vector development.[18]

ATL has three transmission patterns: wild – anthropic actions bring man closer to the forest, habitat of wild animals; occupational - occurs in areas of exploitation of forests related to deforestation and construction; and rural or peri-urban - related to migratory areas and occupations in urban regions, close to secondary forests[19], which refers to pattern transmission of the city of Cametá, since it presents characteristics of territorial expansion and similar socioeconomic activities.

The increase in cases of ATL in males observed in the present study is concentrated among young people and adults, who are in productive phase, who carry out deforestation and/or reforestation activities, in addition to agricultural practices and logging, road construction, subdivisions, activities in tropical forests, communities adjacent to forests, among others.[20] In an analysis in Petrolina-PE, similar results were also obtained regarding the higher incidence rate in economically active men, as it is linked to the fact that these are more present in places outside the home.[21]

Regarding disease transmission in women, older adults and children, it can be related to the adaptation of the vectors to the poorest households, with a deficiency in water supply, garbage collection, in addition to living with domestic animals.[22] It assumes that the drop in the number of cases, mainly in children, is due to the fact that they have remained on a smaller scale in forest environments, in addition to underreporting, culminating in flaws in the municipality's current epidemiological situation. However, despite the low records of VL among female individuals, these are not exempt from infestations, since in socioeconomically precarious areas they become propitious due to invasions in the indoor environment, such as contaminated dogs.[22] Studies highlight a significant number of cases of the disease in women and children in different regions of South America, which is an indicator of intra and peridomestic vector circulation.[23]

The illness process depends solely on the vector and a host/reservoir. Changes in the natural landscape, environmental degradation with loss of vegetation cover are the key to the responses of the large number of cases in these localities.

As for ATL, 25.9% of cases were reported in urban areas, which demonstrates an expansion of the disease dynamics throughout the territory. When verifying the vulnerability of the urban population of Araguaína, it was observed that 30% of cases of leishmaniasis were in the city, with a prevalence in those aged 60 years or more.[21] Spatial distribution of cases in humans suggests that the epidemic process is in motion, due to the displacement of populations from wild reservoirs to areas close to homes in search of survival.[23] A common characteristic observed is that, in the neighborhoods where the infections are present, they are close to primary and/or secondary forest areas of the legal Amazon, which is in line with specialized literature.[12]

As for the most affected age group being among people from 20 to 30 years old, a different result is demonstrated, if compared with other studies in the extreme north of Brazil, in which the highest occurrence was among children under 10 years of age (86, 8%), with a second peak in the age group of 20 to 29 years (5.1%). Another similar data is that of Alagoas, which, according to an epidemiological survey between 2013 and 1017, 39% of ATL cases were in individuals aged between 20 and 49 years.[18]

According to figure 3, two peaks of the disease are observed, with the highest occurring in 2008 and another in 2012. Similar studies such as those by Temponi,[24] when assessing ATL spatial circuits in Minas Gerias, obtained outbreaks of the disease in the same period.

There was a decline in the incidence coefficients and low lethality rate in the sample municipality. A similar case occurred in an epidemiological study in Barcarena, Pará, between 2004 and 2008, due, in part, to the intensification of local surveillance actions, such as the expansion in the coverage of health units and investments in the structuring of programs to combat VL. The Ministry of Health also presented similar results when assessing the epidemiological situation of VL in the country in 2017.[10]

It was possible to verify that children aged between 1 and 9 years were the most vulnerable in the analyzed period, 59.2% of the cases, since they are more exposed to the vector in the peridomicile, so common in endemic areas, in addition to their relative immunological immaturity cell, aggravated by the malnutrition of economically poor populations.[25]

Regarding patients' residence, 80.5% live in rural areas. According to epidemiological records, the infection was more prevalent in rural areas, demonstrating an endemic nature in these regions. VL is a neglected disease of neglected populations. Factors such as poverty, migration, unplanned urban occupation, environmental destruction, precarious sanitation/housing conditions and malnutrition are some of the determining factors.[26]

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The municipality's economic base is agriculture, extraction works and fish farming, present both in families in island areas and in urban centers. The rural population represents a significant portion in the municipality of Cametá, corresponding to 56.30% of the total, with 70.96% living below the poverty line.[19] These individuals, in addition to living and working in forested regions, carry out agriculture and family livestock activities, and thus consequently are vulnerable to bites by transmitting vectors. Due to agrarian changes in recent decades, today 85% of the population lives in urban areas, leading to the emergence and re-emergence of parasitic diseases, including VL.[24]

It is also important to emphasize that, despite the rural character, 19.5% of cases still occur in the urban area, showing the expansion and urbanization of VL. For the Brazilian Society of Tropical Medicine, the domestic dog is the main reservoir-transmitter in the urban environment as well as the sand fly (*Lutzomyia longipalpis*), the latter of greater epidemiological importance.[25] The pillars of the current Visceral Leishmaniasis Control Program (PVCVL - *Programa de Controle da Leishmaniose Visceral*) are established in Ordinance 1.399 of December 15, 1999, emphasizing early diagnosis, as well as treatment of human cases, through the reduction of sandfly populations and elimination of infected reservoirs.

In view of this, laboratory diagnosis methods are emphasized, as they are important not only for confirming clinical findings, but also provide epidemiological information, through the identification of circulating species, which are fundamental to direct combat and control measures.

Based on this, the study provided knowledge of ATL and VL in the municipality of Cametá, pointing out the main epidemiological characteristics of the disease. In both diseases, males were the most affected, residents of rural spaces who carry out field activities. As for age, ATL was predominant among individuals between 20 and 30 years of age, as they are economically active, something different from VL's behavior, with a higher occurrence in those younger than 10 years of age.

With such findings, it is possible to bring more visibility to this population that is vulnerable to the disease and, from this, propose more effective solutions to local secretariats, with the aim of intervening in the high curve of cases.

Preventive actions are necessary for the Cametá community, in order to keep the population informed about leishmaniasis, promoting, together with public health agencies, the fight against transmission of the vector in the region. Given the high number of cases not only in the rural area, but also in urban centers, it is emphasized that disease reporting is of great concern, thus characterizing a possible expansion in the dynamics of leishmaniasis in the municipality.

Considering the high number of rural cases, it is noteworthy that reporting in urban areas is also worrying, in addition to the means of subsistence of local families, as it has been making them vulnerable to illness. Moreover, there is concern about the possible expansion and change in ATL pattern in the municipality. The Municipal Department of Health as well as the epidemiological surveillance department must pay attention and promote campaigns to combat and treat this important public health problem, as well as investments and actions of public management policies. Preventive work for the Cametá community is of paramount importance in order to keep the population informed about leishmaniasis, which historically plagues the region.

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Lucas Henrique da Silva e Silva, Marcelo Coelho Simões and Beatriz Oliveira Miranda contributed to article conception, design, analysis and writing;

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