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Epidemiological aspects and spatial distribution of visceral leishmaniasis in Picos, Piauí, Brazil

Aspectos epidemiológicos y distribución espacial de la leishmaniasis visceral en Picos, Piauí, Brasil

Aspectos epidemiológicos e distribuição espacial da leishmaniose visceral em Picos, Piauí, Brasil

ABSTRACT

Objective: This study aimed to investigate demographic characteristics and spatial distribution of visceral leishmaniasis (VL) in Picos. **Methods:** Data of VL cases from 2007 to 2019 were obtained from reports forms from the Brazilian National Information System for Notifiable Diseases, through the Municipal Health Secretary. **Results:** A total of 64 cases were confirmed. The disease occurred in all studied years, except for 2018. The mean incidence rate was 6.6/100,000 inhabitants. The mean lethality rate was 14.1%. Most of the cases occurred in males, children, people of brown ethnicity and residents in the urban area. HIV-coinfection occurred in 6.3% of the cases. The disease was reported in 14 neighborhoods of the municipality. **Conclusion:** Thus, our study supports the relevance of surveillance for VL in the inland areas from the state, in order to pursue changes in the epidemiological profile of the disease and to establish appropriate control measures.

DESCRIPTORS: Visceral leishmaniasis; Epidemiology; Brazil.

RESUMEN

Objetivo: Éste estudio tuvo como objetivo investigar las características demográficas y la distribución espacial de leishmaniasis visceral (LV) en Picos. **Métodos:** Los datos de casos confirmados de LV de 2007 a 2019 en Picos se obtuvieron de los registros del Sistema de Información de Enfermedades de Notificación a través de la Secretaría de Salud Municipal. **Resultados:** Se confirmaron un total de 64 casos. La enfermedad se presentó en todos los años estudiados, excepto en 2018. La tasa de incidencia media fue de 6,6/100.000 personas. La tasa de mortalidad media fue de 14,1%. La mayoría de los casos ocurrieron en niños y adultos del sexo masculino, de color marrón y residentes en el área urbana. La coinfección por VIH en el 6,3% de los casos. La enfermedad se confirmó en 14 barrios del municipio. **Conclusión:** Así, nuestro estudio confirma la importancia de la vigilancia de LV en zonas del interior del estado, para detectar posibles cambios en el perfil epidemiológico de la enfermedad así como para establecer las medidas de control adecuadas.

DESCRIPTORES: Leishmaniasis visceral; Epidemiología; Brasil.

RESUMO

Objetivo: Objetivou-se investigar o perfil epidemiológico e a distribuição espacial da leishmaniose visceral (LV) em Picos. **Métodos:** Dados de casos de LV de 2007 a 2019 foram obtidos de registros do Sistema de Informação de Agravos de Notificação através da Secretaria Municipal de Saúde. **Resultados:** Um total de 64 casos foram confirmados. A LV ocorreu em todos os anos, exceto em 2018. A taxa de incidência média foi de 6,6/100 mil habitantes e a taxa de letalidade média foi de 14,1%. A maioria dos casos ocorreu em crianças e adultos do sexo masculino, de cor parda e residentes na área urbana. Coinfecção com HIV ocorreu em 6,3% dos casos. A doença foi confirmada em 14 bairros do município. **Conclusão:** O estudo ratifica a importância da vigilância para LV em áreas do interior do estado, para detecção de mudanças no perfil epidemiológico da LV bem como estabelecer medidas de controle apropriadas.

DESCRIPTORES: Leishmaniose visceral; Epidemiologia; Brasil.

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Magna de Souza Abreu

Medical Student at the Federal University of Piauí, Campus Senador Helvídio Nunes de Barros - Picos, PI.
ORCID: 0000-0002-3728-7020

José Matheus Macedo Torquato de Siqueira

Medical Student at Federal University of Piauí, Senador Helvídio Nunes de Barros Campus - Picos, PI.
ORCID: 0000-0001-5996-5315

José Cleves da Silva Maia

Biologist (UFPI/CSHNB), Master's student in Animal Science at the Federal University of Vale do São Francisco - Petrolina, PE.
ORCID: 0000-0003-0934-235X

Denise Barguil Nepomuceno

Biomedical (UNINOVAFAP), Master in Parasitology (UFMG), PhD in Parasitology (UFMG). She is currently a postdoctoral resident at the Federal University of Minas Gerais - Belo Horizonte, MG.
ORCID: 0000-0003-3314-0491

Ellen Barros Araújo Lopes Luz

Physician (UPE), Specialist in Pediatrics (UFPI), Professor of Medicine at the Federal University of Piauí, Campus Senador Helvídio Nunes de Barros - Picos, PI.
ORCID: 0000-0002-7169-7832

Antonio Ferreira Mendes-Sousa

Veterinarian (UFPI), Master in Parasitology (UFMG), Doctor in Parasitology (UFMG), Professor of Medicine and Nursing courses and member of the Medical Sciences Research Center at the Federal University of Piauí, Senador Helvídio Nunes de Barros Campus - Picos, PI.
ORCID: 0000-0002-2019-1348

INTRODUCTION

Visceral leishmaniasis (VL), also known as kala azar, is a chronic tropical disease considered a public health problem in more than 80 countries and mainly affects areas of poverty in Asia, Africa, South America and the Mediterranean region.^{1,2} In Latin America, more than 90% of cases occur in Brazil, with 4.200 to 6.300 new cases registered annually.^{3,4} In Brazil, VL is caused by the protozoan *Leishmania infantum*, transmitted by sandflies of the genus *Lutzomyia* and has domestic dogs as the main reservoirs of the parasite.^{3,5} The disease is characterized by prolonged fever, weight loss, asthenia, hepatosplenomegaly and anemia, progressing to death if left untreated.⁶

Initially rural, LV has spread widely across the country, currently occurring in 21 of the 27 Brazilian federal units.⁶ The urbanization of LV has been described since the 1980s in large cities such as Teresina and Belo Horizonte^{7,8}, becoming a serious public health problem as it occurs in urban epidemics and the possibility of evolving to severe forms that require hospitalization, with high mortality and lethality rates, especially in children and

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people with comorbidities. VL is a notifiable disease and in recent years it has maintained an incidence of 2 cases/100.000 inhabitants in the country, but the lethality rate increased from 3,1% in 2000 to 7,1% in 2018⁹, requiring surveillance and control actions in endemic areas.

In the state of Piauí, VL is endemic, with the first cases reported in 1934.¹⁰ Teresina, its capital, registered more than a thousand cases of the disease between 1981 and 1986, this being the first major urban epidemic of VL in Brazil.¹¹ In addition, between 1999 and 2009, Piauí registered 2.498 cases of the disease, 1.369 in its capital Teresina, which led to several studies on its eco-epidemiological aspects.^{11,13-15}

Despite the endemicity of VL in the state, data on the occurrence of the disease outside the capital are scarce and inaccurate. In Picos, the third most populous city and important economic center in the state, LV has been registered since the 1970s¹⁰ but the dynamics of its occurrence and distribution is not yet well known. The municipality is located in the southeastern region of the state of Piauí, 315 km from the capital, belonging to the caatinga biome with a semi-arid tropical climate, average annual rainfall of 795,4 mm and average

ge temperature of 28°C.^{16,17} Its estimated population is 78.222 inhabitants, 80% of whom live in urban areas.¹⁶ In addition, it has the second largest road junction in the Northeast region, with an intense flow of people from areas endemic to LV, such as the capital Teresina and the neighboring states Ceará and Pernambuco.^{8,18,19}

Thus, this study aimed to investigate the situation of visceral leishmaniasis in Picos, Piauí, through the evaluation of its epidemiological characteristics and spatial distribution.

METHOD

This is a qualitative and quantitative study based on a retrospective descriptive epidemiological analysis using data recorded in the visceral leishmaniasis forms of the Notifiable Diseases Information System (SINAN). Data on cases of VL recorded from January 2007 to December 2019 in Picos were obtained from SINAN through the Department of Epidemiological Surveillance of the Municipal Health Secretariat. All confirmed cases of VL in individuals residing in Picos were included. Cases of VL diagnosed in Picos in residents of other municipalities were excluded from the research.

Data were obtained from May to July 2020 and stored in a Microsoft Excel version 2016 spreadsheet for organization and

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analysis. Relative frequencies were calculated for the following variables: age, sex, skin color, zone and co-infection with human immunodeficiency virus (HIV). Incidence rates have been calculated for 100.000 inhabitants. The lethality rate was calculated by dividing the number of annual deaths from VL by the number of confirmed cases in the respective year and then multiplied by 100. Data on the annual population estimate were obtained from the Brazilian Institute of Geography and Statistics - IBGE. The construction of the indicator graph and the spatial distribution map was performed, respectively, with the software GraphPad Prism 6 and QGIS 3.10. The study was approved by the Research Ethics Committee of the Federal University of Piauí with protocol number 3.579.481 (CAAE 20387019.6.0000.8057).

RESULTS

From 2007 to 2019, 120 cases of VL were reported in Picos, of which 64 were confirmed. The annual average was 4,9 cases. In all the years studied, there was at least one registered case of the disease, except for the year 2018 (Figure 1). The largest number of cases occurred in 2008, with 12 confirmed cases, followed by 2009 and 2011 with 11 and 9 cases, respectively. There was a decline in cases in subsequent years, up to 0 cases in 2018. The incidence rate increased from 1,38 in 2007 to 16,65 in 2008 and then decreased over the years to 0,0 in 2018 (Figure 1). An increase in incidence to 5.11 was observed in 2019, which presented 4 new cases. The average incidence was 6.6 cases per hundred thousand inhabitants. Nine deaths from VL were recorded, with an average lethality rate of 14,1% (Figure 1).

Most cases occurred in males (59,4%, n = 38). The age of the patients ranged from 4 months to 87 years. Children from 0 to 10 years old were the most affected (40,6%, n = 26), followed by adults from 21 to 31 years old (17,2%, n = 11) and 31 to 40 years old (15,6%, n = 10) (Table 1). The disease predominated in the urban area (71,9%, n = 45), and the majority of

Figure 1: Number of cases, incidence rate and lethality rate of visceral leishmaniasis in Picos, Piauí, Brazil, from 2007 to 2019.

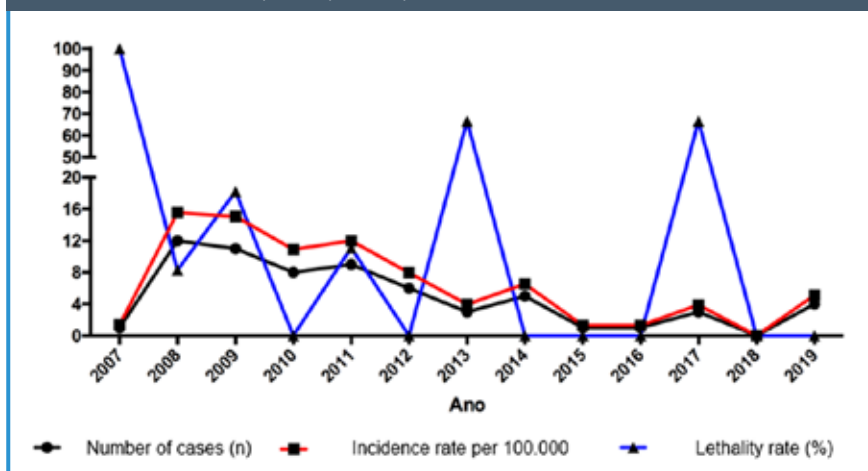
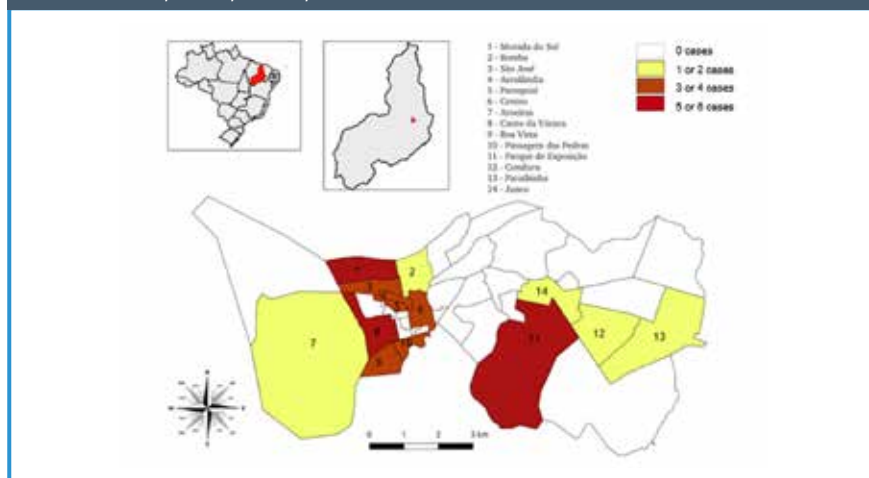


Table 1: Visceral leishmaniasis in Picos, Piauí, Brazil, according to sex, age, skin color, zone and HIV co-infection from 2007 to 2019.

| VARIABLE | N | % |
|-------------------------|----|------|
| Sex | | |
| Female | 26 | 40,6 |
| Male | 38 | 59,4 |
| Age | | |
| 0 – 10 years | 26 | 40,6 |
| 11 – 20 years | 5 | 7,8 |
| 21 – 30 years | 11 | 17,2 |
| 31 – 40 years | 10 | 15,6 |
| 41 – 50 years | 3 | 4,7 |
| 51 – 60 years | 2 | 3,1 |
| > 60 years | 7 | 10,9 |
| Skin color | | |
| Black | 4 | 6,3 |
| Brown | 51 | 79,7 |
| Yellow | 1 | 1,6 |
| White | 4 | 6,3 |
| Ignored | 4 | 6,3 |
| Area | | |
| Rural | 19 | 28,1 |
| Urban | 45 | 71,9 |
| HIV co-infection | | |
| No | 52 | 81,3 |
| Yes | 4 | 6,3 |
| Ignored | 8 | 12,5 |

Figure 2: Spatial distribution of cases of visceral leishmaniasis in the urban area of Picos, Piauí, Brazil, from 2007 to 2019.



Source: SINAN, 2020

cases (79,7%) were registered in brown people. Leishmania-HIV co-infection was registered in 6,3% ($n = 4$) of the individuals (Table 1). This information was ignored in 12,5% ($n = 8$) of the cases.

Visceral leishmaniasis was confirmed in 14 neighborhoods in the urban area of Picos (Figure 2). The largest number of cases was registered in the Parque de Expo district ($n = 6$), followed by the Morada do Sol and Canto da Várzea neighborhoods, with 5 cases. The neighborhoods Aerolândia, Boa Vista, Centro and Passagem das Pedras presented 4 cases. The neighborhoods São José and Paroquial registered 3 cases, while Paraiquê and Aroeira, 2 cases. One case was confirmed in the Conduru, Bomba and Junco neighborhoods.

DISCUSSION

An outbreak of VL was observed in Picos in 2008, with a sharp increase in the incidence rate. Then, a decline was observed until the year 2019, following the decreasing trend of cases of VL in Brazil and Piauí after the year 2000.^{4,21} According to the Ministry of Health classification, the municipality has moved from an area of intense transmission of VL (average of cases in the last 3 years > 4,4) to an area of sporadic transmission (average of cases in the last 3 years > 0 and < 2,4) in recent years.⁶ However, after a major decline from 2008 to 2018, the incidence of VL in Picos increased again in 2019, ratifying the importance of maintaining epidemiological surveillance and control measures in the municipality to prevent cyclic behavior of VL as it has occurred in other areas, with outbreaks at periodic intervals.^{11,21-23}

There was also a decrease in the lethality rate to 0% in 2019. However, the average lethality per VL in the evaluated period remained higher than the national average of 6,9%.⁹ High mortality rates may be due to poor health services, leading to late diagnosis and treatment of patients.²⁴ The toxicity of the treatment, co-infections and immunosuppression can also favor an increase in the lethality rate.²⁴

VL predominated in men and children, following the pattern of the disease in Brazil.²⁰⁻²³ The higher incidence in men may have a behavioral cause, as men are more involved in nighttime activities outside the home, being more exposed to the vector, in addition to being a physiological cause, as high levels of testosterone stimulate Th2 type anti-inflammatory immune response, making it those most susceptible to *Leishmania*.²⁵ The high incidence observed in adults confirms changes described in the epidemiology of VL in Brazil, with increasing cases in adults.^{20,21} Children are known to be more susceptible to the parasite due to the immaturity of the immune system.

Among the confirmed cases, 6,3% were infected with HIV, lower than the relative frequencies of co-infection in Brazil (8,5%).²⁶ This can be explained by the average size of Picos, since HIV is more prevalent in large cities.²⁷ However, as in 12,5% of cases the HIV status was ignored, it is possible that the proportion of co-infected individuals is higher. In addition, the majority of cases occurred in brown people, as reported in other northeastern municipalities.²⁸

The cases of VL predominated in the urban area, in agreement with the process of urbanization of the disease in Brazil.⁷ In fact, the vector *Lutzomyia longipalpis* has already been captured in houses in the urban area of Picos.²⁹ The municipality is located in a biome that favors the development of the vector, in addition to having many hills and being cut by the Guaribas River, creating favorable areas for the transmission of *Leishmania* (eg, hillsides and river banks).⁸ The neighborhood with the highest number of cases (Exhibition Park) is located on the outskirts of the city and is characterized by unfavorable socioeconomic conditions, such as basic sanitation and inadequate or nonexistent garbage collection, factors associated with the high incidence of VL.¹⁵ However, most nei-

ghborhoods with a high number of cases are located in the central area of the city, with urban characteristics, such as paved streets, electricity and running water. However, these neighborhoods have areas of concentration of poverty and some are located at the foot of hills, favoring the development of the vector and the transmission of the parasite. The spatial distribution map can help municipal health institutions

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to identify priority areas for VL surveillance and control.

The present study used secondary data from the SINAN forms of visceral leishmaniasis, constituting a limitation due to the possible incomplete filling by health professionals, which hinders deeper analysis of the epidemiology of VL in Picos. In addition, it is possible that the disease is underreported in Picos due to the limitations of laboratory diagnosis in the municipality, as reported in other Brazilian cities.¹⁹ However, as VL has been a compulsory notification disease in Brazil since the nineties, known to be endemic in Picos and its specific treatment is provided only by the Unified Health System. We assume that such possible failures are minimal and that the data obtained in the study represent the majority of the cases that occurred during the determined period, representing, therefore, the reality of the occurrence of the disease in the municipality. Thus, our study presents for the first time an overview of the epidemiological aspects and spatial distribution of visceral leishmaniasis in Picos, an important commercial center and an endemic area in the state of Piauí, which may support measures for the prevention and control of the disease in the state.

CONCLUSION

Visceral leishmaniasis is endemic and well distributed in the urban area of Picos, with decreasing incidence and lethality rates in recent years but still above the national average. The disease occurs predominantly in children up to 10 years old and in male adults, brown in color and living in the urban area. Our study reinforces the importance of epidemiological surveillance for VL in Picos and the need to train physicians in the Family Health Strategy for early diagnosis and treatment of the disease, in order to avoid an increase in the incidence of the disease and an unfavorable evolution of the patients. In addition, the knowledge of the spatial distribu-

tion of cases in the municipality serves as a basis for directing prevention strategies by health authorities to priority risk areas, reducing costs and potentially increasing their effectiveness in combating VL in Picos. ■

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