

## Epidemiological analysis of the American Cutaneous Leishmaniasis cases in a municipality of Triângulo Mineiro

### Análise epidemiológica dos casos de Leishmaniose Tegumentar Americana em um município do Triângulo Mineiro

### Análisis epidemiológico de casos de Leishmaniasis Cutánea Americana en un municipio de Triângulo Mineiro

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This study aims to analyze the epidemiological profile of American cutaneous leishmaniasis in the municipality of Patrocínio, Minas Gerais, Brazil, from 2007 to 2018. It is a descriptive epidemiological research, from data of the Information System for notifiable diseases of the Ministry of Health. In this city, 21 cases were reported in the period, with an average incidence of 0.21 cases of American cutaneous leishmaniasis for every 10,000 inhabitants. The profile of individuals affected consisted of men (90.48%), white (71.43%), from 50 to 64 years (33.33%), residents of urban area (90.48%) with complete primary education (23.81%) and with clinical presentation of cutaneous form (85.71%). All cases were new and evolved to cure in 80.59%. Although American Cutaneous Leishmaniasis manifests itself with low incidence in the municipality, it is observed maintenance of its occurrence over the twelve years analyzed, appearing as an endemic disease in the local.

**Descriptors:** Leishmaniasis; Disease prevention; Public health surveillance; Zoonoses.

Este estudo tem o objetivo de analisar o perfil epidemiológico da Leishmaniose Tegumentar Americana no município de Patrocínio, Minas Gerais, Brasil, no período de 2007 a 2018. Trata-se de uma pesquisa epidemiológica descritiva a partir dos dados do Sistema de Informação de Agravos de Notificação do Ministério da Saúde. Nesta cidade foram notificados 21 casos no período, com uma incidência média de 0,21 casos de Leishmaniose Tegumentar Americana a cada 10 mil habitantes. O perfil dos indivíduos acometidos foi composto por homens (90,48%), brancos (71,43%), entre 50 e 64 anos de idade (33,33%), moradores da zona urbana (90,48%), com ensino fundamental completo (23,81%) e com a apresentação clínica na forma cutânea (85,71%). Todos os casos eram novos e evoluíram para cura em 80,59%. Embora a Leishmaniose Tegumentar Americana se manifeste com uma incidência baixa no município, observa-se a manutenção da sua ocorrência ao longo dos doze anos analisados, figurando-se como uma doença endêmica no local.

**Descritores:** Leishmaniose; Prevenção de doenças; Vigilância em saúde pública; Zoonoses.

Este estudio tiene el objetivo de analizar el perfil epidemiológico de la Leishmaniasis tegumentar Americana en el municipio de Patrocínio, Minas Gerais, Brasil, en el período de 2007 a 2018. Se trata de una investigación epidemiológica descriptiva a partir de los datos del Sistema de Información de agravios de Notificación del Ministerio de Salud. En esta ciudad se notificaron 21 casos en el período, con una incidencia media de 0,21 casos de Leishmaniasis tegumentar Americana por cada 10 mil habitantes. El perfil de los individuos afectados estaba compuesto por hombres (90,48%), blancos (71,43%), entre 50 y 64 años de edad (33,33%), residentes de la zona urbana (90,48%), con educación primaria completa (23,81%) y con la presentación clínica en forma cutánea (85,71 por ciento). Todos los casos eran nuevos y evolucionaron para la curación en un 80,59%. Aunque la Leishmaniasis tegumentar Americana se manifiesta con una incidencia baja en el municipio, se observa el mantenimiento de su ocurrencia a lo largo de los doce años analizados, considerándose como una enfermedad endémica en el local.

**Descriptores:** Leishmaniasis; Prevención de enfermedades; Vigilancia en salud pública; Zoonosis.

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## INTRODUCTION

Leishmaniasis are antropozoonoses representing a major public health problem<sup>1</sup>. Due to its broad spectrum of clinical manifestations, they are divided into Localized Cutaneous Leishmaniasis (LCL), Mucocutaneous Leishmaniasis (MCL), Diffuse Cutaneous leishmaniasis (LCD) and Disseminated leishmaniasis (LD), all variants of American Cutaneous Leishmaniasis (ACL). In addition to the ACL, it can also be cited Visceral Leishmaniasis (VL)<sup>2</sup>.

In Brazil, seven species of *Leishmania* responsible for ACL have been described, in which the most important are: *Leishmania (Leishmania) amazonensis*, *L. (Viannia) guyanensis* and *L. (V.) braziliensis*. The sandfly vectors are insects belonging to the *Lutzomyia* sort, popularly known as straw flea, tatuquira or birigui<sup>3</sup>.

For the treatment of ACL pentavalent antimony as first line drugs are used. In cases of resistance, it is indicated unavailability or the use of second-line drugs, such as amphotericin B and pentamidine<sup>4</sup>. The high cost, difficulty of administration, the long treatment time, toxicity and increased morbidity are factors that limit the use of drugs, a fact that contributes to non-adherence and disposition of complications such as the extent of the disease in the mucous membranes or desfigure injuries<sup>1</sup>.

ACL is considered one of the dermatological disorders that deserves attention due to its magnitude, taking into account the occurrence of deformities in humans, specific to those diseases and also the psychological involvement, reflected in social and economic areas<sup>3</sup>. Leishmaniasis are among the neglected diseases due to limited resources invested in their diagnosis, treatment and control, along with its strong association with poverty and social conflicts<sup>1</sup>.

It presents worldwide distribution and the Americas there is record of cases from the southern United States to northern Argentina, with the exception of Chile and Uruguay<sup>1</sup>. In 2017, 17,528 new cases were registered in Brazil, with detection rate of 8.4 cases/100,000 inhabitants<sup>5</sup>. The Northern region has the highest rate (43.7 cases/100,000 population), followed by the Midwest (15.2 cases/100,000 population), Northeast (7.4 cases/100,000 population), Southeast (1.8 cases/100,000 inhabitants) and South (0.6 cases/100,000 population)<sup>5</sup>.

Thus, in recent years, the Ministry of Health of Brazil has invested in the search for new knowledge and alternatives to control this endemism<sup>5</sup>. The main lines of research focus on implementing human laboratory diagnosis, treatment of patients with leishmaniasis, evaluating the effectiveness of vector and reservoir control strategies and new technologies that can contribute to the implementation of surveillance and control of leishmaniasis in the country<sup>6</sup>.

As a result, leishmaniasis is a disease that must be reported and investigated by the health services, through the notification form and standardized investigation by the national Notifiable Diseases Information System<sup>7</sup>. Its registration on the official health surveillance systems is important for the knowledge of the epidemiological profile and follow up with a view to proposing strategies for prevention and control<sup>1</sup>.

Since it is a disease of clinical and epidemiological importance in Brazil, with several geographical, surveillance in health and ecological factors involved in the dynamics of the disease<sup>8</sup>, the analysis of the epidemiological profile of ACL in Patrocínio, Minas Gerais-MG is justified. Thus, this study aims to analyze the epidemiological profile of ACL in Patrocínio, Minas Gerais, Brazil, from 2007 to 2018.

## METHOD

This is an epidemiological descriptive study, based on secondary data from ACL, reported in the town of Patrocínio - MG, from January 1, 2007 to December 31, 2018. These data come from the National Notifiable Diseases Information System - SINAN and was made

available according to the protocol 25820006595201811 authorizing access to basic epidemiological data, released by the Ministry of Health (MOH) of Brazil by the Citizen Information System.

The Supporter municipality is located in Triângulo Mineiro, in the Mesoregion Alto Paranaíba for about 419.9 km from Belo Horizonte and has a land area of 2874.344 km<sup>2</sup><sup>9</sup>. It has 82,471 inhabitants, of which 72,758 live in the city, and 9713 has residence in the rural area<sup>9</sup>. Considering the spatial distribution of population, population density is 28.69 inhabitants/km<sup>2</sup><sup>10</sup>. The base of the economy is agriculture and livestock, represented by coffee and dairy cattle, responsible for most of the municipal ICMS collection and according to the Atlas of Human Development in Brazil in 2013, the municipality is located in the High Human Development Index (HDI) between 0.700 and 0.799<sup>10</sup>.

The inclusion criteria used in this study were all the cases of ACL reported in the SINAN, who reported residing in the municipality of Patrocínio, being reported between 2007-2018.

The variables evaluated in relation to the demographic profile were: confirmed cases in residents from Patrocínio - MG; per annum; a month of notification, gender (male and female); age group in categorized years (1 to 4; 15 to 19; 20 to 34; 35 to 49; 50 to 64; 65 to 79); area of residence (urban, rural and peri-urban, ignored or blank); education (illiterate, 1st to 4th incomplete grade, 4th grade, 5th to 8th incomplete, complete primary education, incomplete/complete high school education, incomplete/complete higher education, ignored), and race/color (white, black, yellow, brown, native or ignored).

Regarding the clinical, laboratorial and treatment profile, the following parameters were evaluated: clinical form (cutaneous and mucous); Initial drug treatment (pentavalent antimony, amphotericin B, liposomal amphotericin B and other drugs); prescribed dose (<10;> or = 10 to <20, 15,> 15 and <20;> or = 20 and ignored or blank) and the type of entry (new case, recurrence and transfer) and outcome (healing, abandonment, transfer and ignored or blank).

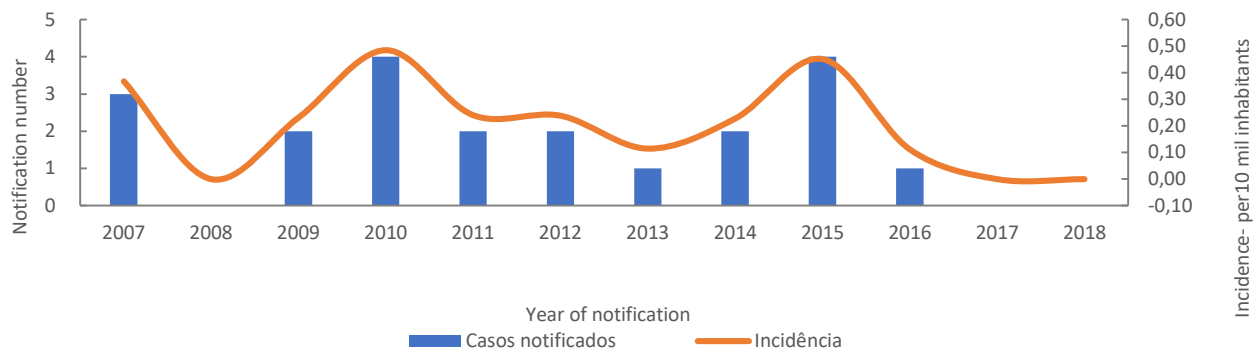
Information obtained by the SINAN database were accessed on April 30, 2019, being transformed into tables and subsequently using Microsoft Excel, version 2013, for the construction of graphics. Descriptive statistical analysis was performed and the data were presented in gross numbers, relative frequency, and mean percentage arranged in tables and graphs.

To calculate the annual incidence, the number of ACL reported cases per year / city population of Patrocínio x 10 thousand inhabitants was used. Information on the annual population was obtained by the population estimates provided by the IBGE and made available by the Department of Informatics of the Unified Health System of Brazil (DATASUS)<sup>11</sup>.

This study makes an assessment by the Research Ethics Committee, since it uses secondary data, not allowing the nominal identification of the research subjects.

## RESULTS

A total of 21 ACL cases have been reported in the city of Patrocínio - MG, from 2007 to 2018. 2010 and 2015 were the years with the largest number of cases (4 cases, respectively), corresponding to 38.1% of the cases. In 2008, 2017 and 2018 no ACL cases were recorded. The average incidence was 0.21 cases per 10 thousand inhabitants (Figure 1).

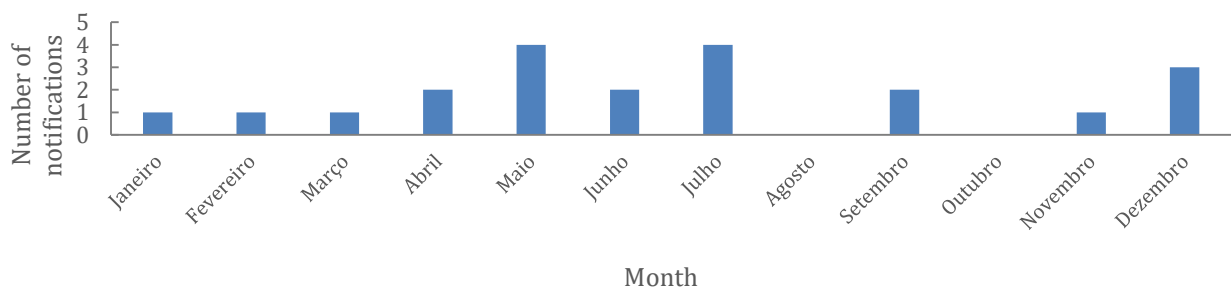


**Figure 1.** American cutaneous Leishmaniasis cases, according to data from the National Notifiable Diseases Information System. Patrocínio, Minas Gerais, 2007-2018.

Source: National Notifiable Diseases Information System - SINAN.

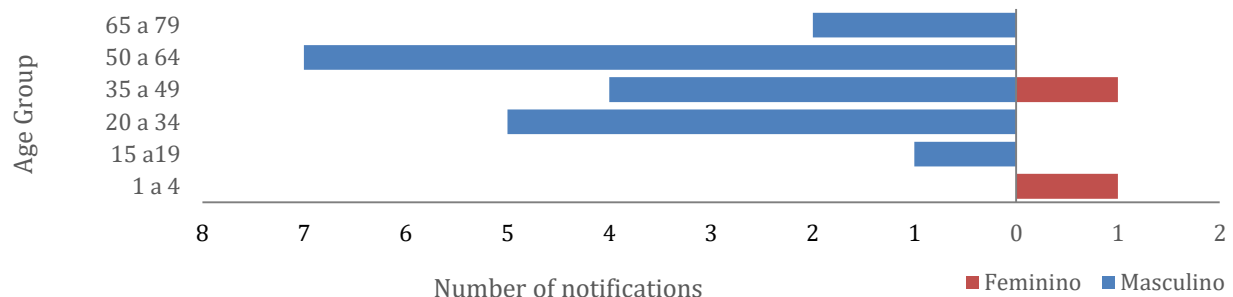
The cases are distributed in every month of the year (except August and October) with the highest attendance record in May and July (38.1%) (Figure 2). It was observed that most individuals affected by the disease are male (90.48% of cases), especially in the ages from 50 to 64 (33.33%) (Figure 3).

Regarding the residence area, one can observe that the disease affected predominantly individuals living in urban areas, with 90.48% of cases. The level of education of individuals most affected was the complete primary education 23.81% and ACL affected white people most, corresponding to 71.43% (Table 1).



**Figure 2.** Case of American Cutaneous Leishmaniasis according to the month of occurrence, in accordance with the National Notifiable Diseases Information System. Patrocínio, Minas Gerais, 2007-2018.

Source: National Notifiable Diseases Information System - SINAN.



**Figure 3.** Occurrence of American Cutaneous Leishmaniasis, according to age group and gender, in accordance with data from the National Notifiable Diseases Information System. Patrocínio, Minas Gerais, 2007-2018.

Source: National Notifiable Diseases Information System - SINAN.

**Table 1.** Sociodemographic profile in reported cases of American Cutaneous Leishmaniasis, in accordance with the National Notifiable Diseases Information System. Patrocínio, Minas Gerais, 2007-2018.

| Variables  | Frequency | Percentage |
|--|-----------|------------|
| <b>Area of residence</b>                         |           |            |
| Urban  | 19        | 90.48      |
| Rural  | 2         | 9.52       |
| Peri-urban                                       | 0         | 0.0        |
| Ignored or blank                                 | 0         | 0.0        |
| <b>Education</b>                                 |           |            |
| Illiterate                                       | 1         | 4.76       |
| 1st to 4th incomplete grade of elementary school | 3         | 14.29      |
| 5th to 8th incomplete grade of elementary school | 2         | 9.52       |
| Complete primary education                       | 5         | 23.81      |
| Complete high school                             | 3         | 14.29      |
| Incomplete Higher Education                      | 1         | 4.76       |
| Ignored or blank                                 | 6         | 28.57      |
| <b>Race/Color</b>                                |           |            |
| White  | 15        | 71.43      |
| Black  | 1         | 4.76       |
| Yellow   | 0         | 0.0        |
| Brown  | 5         | 23.81      |
| Indigenous                                       | 0         | 0.0        |
| Total  | 21        | 100.0      |

Source: National Notifiable Diseases Information System - SINAN.

The clinical presentation of cutaneous was higher frequency, comprising 85.71% of the cases. The subjects were treated exclusively with pentavalent antimony with a prescribed dose ranging between > 15 and < 20 mg/kg/day to 33.33%. All cases in this series were new and were cured in 80.59% (Table 2).

**Table 2.** Clinical, laboratory and treatment profile of reported cases of American Cutaneous Leishmaniasis, according to data from the National Notifiable Diseases Information System Notification, Patrocínio, Minas Gerais, 2007- 2018.

| Variables                        | Frequency | Percentage |
|----------------------------------|-----------|------------|
| <b>Clinical form</b>             |           |            |
| Cutaneous                        | 18        | 85.71      |
| Mucosa                           | 3         | 14.29      |
| <b>Initial drug</b>              |           |            |
| Pentavalent antimony             | 21        | 100.0      |
| Amphotericin B                   | 0         | 0.0        |
| Liposomal amphotericin B         | 0         | 0.0        |
| Other drugs                      | 0         | 0.0        |
| <b>Prescribed dose mg/kg/day</b> |           |            |
| <10                              | 3         | 14.29      |
| > or = 10 and < 20               | 6         | 28.57      |
| 15                               | 1         | 4.76       |
| > 15 and <20                     | 7         | 33.33      |
| > or = 20                        | 2         | 9.52       |
| Ignored or blank                 | 2         | 9.52       |
| <b>Entry type</b>                |           |            |
| New case                         | 21        | 100.0      |
| Recurrence                       | 0         | 0.0        |
| Transfer                         | 0         | 0.0        |
| <b>Case Evolution</b>            |           |            |
| Cure                             | 17        | 80.95      |
| Transfer                         | 2         | 9.52       |
| Ignored or blank                 | 2         | 9.52       |
| Total                            | 21        | 100.0      |

Source: National Notifiable Diseases Information System - SINAN.

## DISCUSSION

It is observed that Patrocínio county - MG has a low incidence of ACL in relation to its population, which is approximately 85 thousand inhabitants. It can be seen that the epidemiological profile of the disorder includes, mainly, men, the urban area, 50 to 64 years, white and affected by the cutaneous form.

In Brazil, from 2007 to 2017, 216,526 cases were reported, and, of these, 72.7% were men, 63.1% of those aged between 20 and 59 years, 60.7% mixed race, 53.9% coming from countryside and 93.8% showing the cutaneous form<sup>12</sup>.

In the Southeast, the number of notifications was 19,205, approximately 8.8% of the total in the country. The epidemiological profile was composed, mostly by men (62.85%), 20 to 59 years (59%), white (40.2%), coming from the urban area (51.3%) and with skin manifestations (88%)<sup>12</sup>.

The state of Minas Gerais, in its turn, included about 70% of the cases of the Southeast (13,437 reports), affecting men (61.8%), between 20 and 59 years old (59.4%), brown (43.5%), from rural area (48.3%) and presenting the cutaneous form (91.6%)<sup>13</sup>.

In the municipality of Patrocínio, the factors gender, age and form of disease presentation are equivalent at the national, regional, state and municipal context<sup>1</sup>. However, the country and the state of Minas Gerais showed brown and countryside as more prevalents<sup>12,13</sup>, opposite from what was found in the Southeast of the country and in the municipality of Patrocínio, in which there are more whites coming from the urban area, in the disease notifications<sup>12 13</sup>.

Studies show that the tops of hills, flat or almost flat areas, when coated with shrub, can become suitable places for the coexistence of reservoir animals, vectors and etiological agents<sup>14</sup>. When there is geographic expansion associated with the modification of primary forest environments by human activity, human disturbance of the evolutionary cycles of *Leishmania* with deforestation, construction of roads and urbanization primitive areas, insect vectors tend to migrate to areas where the soil is not too hilly and where there are small areas of residual forests nearby the environment changed<sup>15</sup>.

The sand flies are winged insects that generally have little tendency to deviate from their natural shelters. However, in exceptional cases, the sand fly can disperse up to 1,500 meters, but usually does not exceed 200-500 m<sup>16</sup>.

The relief of Patrocínio is composed by 60% flat, 30% corrugated and 10% mountainous, covered by savannah vegetation type with a predominance of dirty fields, grasslands, riparian areas (galleries) and rare fields of *campos rupestres*<sup>9</sup>. The surroundings of Patrocínio city is surrounded, mostly, by flat and corrugated relief, shrub and there is great human interference in nature due to the development of livestock and agriculture<sup>9</sup>. Thus, reservoir animals of many infectious diseases usually move to residual forests inserted in the urban and peri-urban limit<sup>14</sup>.

Therefore, it is possible to conclude that the incidence of ACL in the town of Patrocínio - MG has urban prevalence due to the characteristics of the terrain and vegetation of the city that favor the maintenance of etiologic agents of *Leishmania* sp. Moreover, the intense agricultural activity, favoring translocation of reservoir animals and leishmaniasis vectors to green areas present in the urban area, exposes the population living close to these areas with a higher risk of contact with the parasite.

As for the race, it is important that these data are interpreted from the demographics of the resident population by color<sup>17</sup>. Leishmaniasis has no predilection for race, but its incidence is proportional to the ethnic group most prevalent a certain município<sup>17</sup>. Thus, it is justified the greater prevalence of leishmaniasis in Caucasians (71.43%), followed by mulatto (23.81%) and black (4.76%) in Patrocínio due to the population be mostly, white (59.2%), followed by brown race (32%), black (7.8%), yellow (0.8%) and Indian (0.07%). No events were found in the yellow and indigenous races<sup>18</sup>.

The prevalence of ACL in men aged 50 to 64 years (90.48% of cases) was significant with respect to female gender<sup>13</sup>. According to a study that evaluated the epidemiology of leishmaniasis in the State of Alagoas<sup>19</sup>, men would be the most affected by the increased exposure to risk factors for the onset of the disease. The highest incidence of cases in males has been related to the type of men's occupational activity, predominantly rural activities such as agriculture, livestock and mining<sup>20</sup>.

In this research, it was found that the predominant age group was 50-64 years. These results are different from the ACL data in Manaus, AM<sup>21</sup>, in which 20 years was the age group of highest prevalence. According to the HM<sup>1</sup>, this is justified by the fact that in this age group they are in the production phase with occupational encounter in industrial activities, which are often related to deforestation (entries in forest areas) and military activities and domestic work and/or agriculture (subsistence), which shows the most contact with the transmitting vectors that cause this disease. In Patrocínio the results are different due to labor activities being mainly related to men aged 30 to under 60 years<sup>22</sup>.

When compared to cities in the same state, it is possible to emphasize the importance of the disease in the city. Alfenas, for example, has about 75,000 habitantes<sup>23</sup> with only three cases of ACL reported from 2007 to 2017<sup>13</sup>. Ituiutaba, in turn, has a population of approximately 100 thousand people<sup>23</sup>; however, there are 3 cases reported in SINAN in the same period<sup>13</sup>. Already in Lavras, county southwest of the state, with a population estimate of 102,000 habitantes<sup>23</sup>, notified 10 cases in período<sup>13</sup>. In Viçosa with approximately 78 billion residents<sup>23</sup>, 17 people have been identified with the disease during the period searched<sup>13</sup>. However, Paracatu, a town 253 km from Patrocínio, with about the same population age group range<sup>23</sup> had 145 cases of it reported<sup>13</sup>.

When comparing it with the cities across the country, there is a discrepancy among the various municipalities. In Senador Canedo, a city in Goiás state with more than 100,000 inhabitants<sup>23</sup>, there are only five cases reported in the period of the research<sup>24</sup>. Some cities showed no register of the disease between 2007 and 2017, such as São Pedro da Aldeia in Rio de Janeiro<sup>25</sup> (about 100,000 habitantes<sup>23</sup>) and Santana do Livramento, Rio Grande do Sul<sup>26</sup> (about 80,000 residents)<sup>23</sup>. On the other hand, some municipalities reported a high rate of infections by the protozoan, as Cruzeiro do Sul in Acre state, with more than 600 cases recorded in SINAN<sup>27</sup>, and the place has a population less than 90,000 inhabitants<sup>23</sup>.

A possible limitation of the analysis factor is the large number of grievance underreporting in some places<sup>28</sup>. Moreover, it is important to note that many cases are transferred to the referral health centers of the region<sup>1</sup>, as the city of Uberlândia, where cases of the disease are diagnosed, arising from Patrocínio.

Despite the data divergence around the country, it emphasizes the need for improved diagnosis of suspected cases, making it possible to reduce the underreporting of the disease<sup>1</sup>. In addition, Patrocínio has a large number of stray dogs on the streets, which can be parasite reservoirs and they are not diagnosed and treated properly, as well as positive cases are not disclosed to the public, allowing for a lower valuation of this public health problem<sup>1</sup>.

In clinical form, 85.71% of the cases were characterized by the cutaneous form of the disease. Similar studies seeking to evaluate the incidence of the disease in Brazil and in Montes Claros, Minas Gerais City, found that the cutaneous form was also the most prevalent<sup>15,28</sup>. In this sense, it turns out that the form of the disease in Patrocínio followed the same pattern reported in other national studies and also in another city of the same state.

The subjects were treated exclusively with pentavalent antimony, with a prescribed dose ranging between > 15 and <20 mg/kg/day 33.33% of the cases. All cases in this series were new and were cured in 80.59%. A recent work review pointed out that the pentavalent antimony is the drug of choice most used to treat leishmaniasis and that the parasite did not show signs of resistance to the drug<sup>29</sup>. In this sense, it emerges that the cure rates of the disease, were also in line with cure rates reported in other locations.

Importantly, in addition to disease control measures it is necessary to inform the population about the precautionary, transmission and treatment methods by health workers and the population in general<sup>17</sup>.

Health education activities should be included in all services to develop the actions of surveillance and control of ACL, requiring the effective involvement of multidisciplinary and multi-institutional teams, with a view to joint work in different units to provide services<sup>1</sup>.

## CONCLUSION

The epidemiological profile of ACL in Patrocínio is of largest urban prevalence, being justified by the characteristics of topography and vegetation of the municipality, which favor the maintenance of its etiological agents. Moreover, the intense agricultural activity in the region also favors the displacement of leishmaniasis vectors to green areas present in the urban area, exposing the population living next to these places with a higher risk of contact with the parasite.

Still according to the epidemiological profile, it was concluded that the race most affected by cases of ACL was white, because the city has a population composed chiefly of white people. Concomitant to this, there was a significant number of cases in men aged 30 to 60 years, a factor that relates to working-age of the people living in the municipality of Patrocínio.

The cutaneous leishmaniasis form was the most found, by following the same pattern reported in national scientific studies and also in other cities of the state, being pentavalent antimony the drug most used for the treatment.

Among the limitations of this study, it should be punctuated the underreporting of ACL cases that can be reality in the municipality analyzed. Moreover, it is prospected the need for future research papers that seek to assess the correct completion of compulsory notification by active health professionals in the city.

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**All authors** equally contributed to this article design.

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