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ORIGINAL ARTICLE

AMERICAN TEGUMENTARY LEISHMANIASIS IN THE POPULATION OF THE CITY OF RIO BRANCO, ACRE, BRAZIL: A 2007–2015 TIME SERIES ANALYSIS

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ABSTRACT

American tegumentary leishmaniasis (ATL) is a public health problem in the State of Acre. This study analyses the incidence of all forms of ATL time series in the human population from 2007 to 2015. This time series ecological study investigated the incidence of all forms of ATL in the city of Rio Branco, Acre, Brazil. Data on the number of cases of all forms of ATL diagnosed from 2007 to 2015 were collected from the secondary Health Surveillance Board database, Rio Branco City Health Department. Prais–Winsten regression was used to analyze the trends in ATL incidence. Subsequently, the annual percent change (APC) was estimated. The incidence of disease remained stationary during the studied period, except in the age group from 15 to 19 years old with an increase in the annual variation percentage (APC: 6,48%; IC95%: 1,67; 11,53) and a decline between 20 and 34 years old (APC: -15,41%; IC95%: -18,57; -12,13) and 35 and 49 years old (APC: -8,52%; IC95%: -14,63; -1,97). There was a higher frequency of cases between 2007 and 2015 in the cutaneous form, entry of new cases, evolution to cure, and diagnosis by clinical-laboratory procedures. In conclusion, there was a high disease incidence during the studied period. Additionally, an increase in the ATL incidence in the younger age group and a decrease in the ATL incidence in the middle age groups were observed.

KEY WORDS: Cutaneous leishmaniasis; time series study; incidence.

INTRODUCTION

American tegumentary leishmaniasis (ATL) is a public health problem in several countries around the world. According to the World Health Organization (2021), ATL is one of the six most important infectious diseases due to its high detection coefficient and ability to cause deformities.

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In Brazil, ATL is a dermatological disorder that deserves attention to its dimension and risk of deformities (Silva et al., 2010; Coelho Junior et al., 2016; Souza et al., 2015). In particular, psychological involvement is reflected in the social field and economic losses because ATL can be considered an occupational disease in most cases (Ferreira et al., 2012).

ATL is an infectious and non-contagious disease which affects the skin, oral, pharyngeal, and nasal mucosa (Brasil, 2017). Marzochi (1992) classifies ATL in cutaneous and mucosal forms. The two main procedures for diagnosis of ATL are clinical-epidemiological and laboratory criteria. Treatment success is based on patient compliance, and the possible outcomes are cure, treatment abandonment, or death due to ATL. Usually, the primary healthcare team performs the first care and the treatment for new or recurrent ATL cases (Brasil, 2017).

In the State of Acre, which is located in the Western part of the Brazilian Amazon, the prevalence of ATL has increased from 55.7 inhabitants/10,000 in 1992–1997 to 128.5 inhabitants/10,000 in the period of 2001–2006. Specifically, the city of Rio Branco, the capital of the State of Acre, had the highest number of urban residents affected by ATL (Silva & Muniz, 2009; Silva et al., 1999).

The ATL transmission pattern in the city of Rio Branco may be changing as a direct result from deforestation and migratory processes between urban and rural areas. Consequently, the possibility of the domiciliation of sandflies increases. Therefore, in the city of Rio Branco, the susceptibility of the population to be affected by ATL in urban areas may increase (Silva & Muniz, 2009; Melchior et al., 2017).

Thus, this investigation analyzes the percentage of annual variation in the incidence of all forms of ATL in the population of Rio Branco, taking into account sex and age groups, between the years of 2007 and 2015. The second goal was to verify the frequency of ATL by confirmation criteria, input type, clinical form, and cases evolution from 2007 to 2015 period.

MATERIAL AND METHODS

This time series ecological study investigated the incidence of all forms of ATL in the urban and rural areas in the city of Rio Branco, capital of the State of Acre, Brazil. Located in the Amazon biome, specifically in the Western part of Brazilian Amazon, at an altitude of 220 m above the sea, Rio Branco had an estimated population of 370,550 inhabitants in 2015. This city has a territorial area of 883,552 km^2 and a population density of approximately 38.03 inhabitants/km^2 (Acre, 2017). The climate is hot and humid equatorial and has an average annual minimum and maximum temperatures of 21.4°C and 31.1°C, respectively. The annual rainfall is 2,010 mm (INM, 2022).

Data on the number of all forms of ATL were collected from a secondary database from the Health Surveillance Board, Rio Branco´s City Health Department. The notifications of this information made by doctors and nurses that were working in the primary health care in Rio Branco occurred from 2007 to 2015 and were classified by sex and age groups. Additionally, we collected information about the confirmation criterion (clinical-laboratory or clinical-epidemiological), input type (new case or relapse), clinical form (cutaneous and mucosal), and evolution of the case (cure, abandonment, or death). The clinical-laboratory or clinical-epidemiological diagnosis, treatment, and surveillance of the cases followed the recommendations established in the Manual for Surveillance of cutaneous leishmaniasis from the Ministry of Health in Brazil (Brasil, 2017).

The general resident population, was stratified by sex and age, for 2015 from Rio Branco. Data were collected from a database based in the Department of Informatics of the Unified Health System of the Ministry of Health (2019). The incidence was calculated by dividing the number of cases by the population at risk and multiplying by 100.

Prais–Winsten regression was used to analyze the trends in all forms of ATL incidence, in which the independent variable was the year. The dependent variables were the overall incidence of all forms of ATL and all forms of ATL incidence by sex and age group. The method suggested by Antunes & Cardoso (2015) was used to apply the model. In sum, all forms of ATL incidence values were initially logarithmically transformed. Then, the Prais–Winsten regression was used to estimate the beta values and respective confidence intervals (CIs) at 95% of all forms of ATL incidence. Subsequently, the annual percent change (APC) was estimated using the formulas suggested by Antunes & Cardoso (2015). Also, the frequency of cases was calculated for confirmation criteria, input type, clinical form, and case evolution between the period from 2007 and 2015.

This study used secondary data from the Sanitary Surveillance Board of the City Health Department of Rio Branco database, provided without any patient identification. Therefore, formal ethical procedures were not required.

RESULTS

The time series of new cases in all forms of ATL in Rio Branco from 2007 to 2015 period included the analysis of 2,135 cases. From these, 1,629 cases (76.2%) were male patients and 1,382 cases (64.7%) were aged 15 to 49 years old. The highest incidence occurred in 2008 (8.5%), and the lowest in 2011 (6.1%). In all the years studied, the incidence of all forms of ATL was higher in men than in women (Table 1).

The incidence of all forms of ATL was high during the study period. There was an increase from 7.3 in 2007 to 11.9 in 2015 in the 15–19 age group. In the 20–34 age group, all forms of ATL incidence decreased from 8.6 in 2007 to 5.0 in 2015. Also, all forms of ATL incidence decreased from 9.5 in 2007 to 6.9 in 2015 in the 35–49 age group (Table 1).

Table 1. Time series of the incidence from all American Tegumentary Leishmaniasis forms from 2007 to 2015 in Rio Branco, Acre, Brazil.

	2007	2008	2009	2010	2011	2012	2013	2014	2015
	%	%	%	%	%	%	%	%	%
All	7.0	8.5	7.7	8.3	6.1	7.5	6.2	6.3	6.6
Sex									
Male	11.8	13.0	11.9	13.0	9.2	12.4	10.3	9.2	10.2
Female	2.5	4.3	3.8	3.8	3.0	2.8	2.4	3.5	3.2
Age range									
<1 year old	2.6	5.8	3.2	4.8	3.4	3.1	6.1	2.9	7.3
1–4	2.3	3.1	5.6	7.0	1.6	3.5	1.2	2.7	2.4
5–9	2.7	7.3	5.1	4.8	4.6	6.4	3.6	4.4	3.4
10–14	3.7	10.1	8.9	6.9	6.7	7.4	5.1	7.6	7.5
15–19	7.3	9.5	8.9	10.1	8.8	10.1	9.1	9.7	11.9
20–34	8.6	10.2	7.8	8.8	7.4	7.2	6.8	5.8	5.0
35–49	9.5	8.9	10.0	10.5	6.7	8.6	8.6	7.3	6.9
50–64	13.5	7.6	6.3	6.4	3.9	8.3	4.7	6.1	9.3
65–79	9.5	5.9	3.1	10.2	1.7	5.1	5.9	4.9	9.7
80 and +	8.4	3.7	11.8	0	3.2	9.5	6.2	3.0	2.9

These results indicate a stable trend in the incidence of all forms of ATL from 2007 to 2015. However, the age group from 15–19 years old showed a significant increase trend (APC: 6.48%; 95% CI: 1.67; 11.53; p=0.015). Conversely, from 20 to 34 years old (APC: -15.41%; 95% CI: -18.57; -12.13; p<0.001) and from 35 to 49 years old (APC: -8.52%; 95% CI: -14,63; -1.97; p=0.019) there was a significant decreasing trend (Table 2).

Graphical representations revealed the temporal trend of confirmation criteria, input type, clinical form, and evolution of the case between 2007 and 2015 (Figure). In confirmation criteria, the sum of tests performed between 2007 and 2015 revealed 1,918 cases (89.8%) diagnosed by clinical-laboratory criteria and 217 cases (10.1%) by clinical-epidemiological criteria. In all years, the clinical laboratory criterion was the most used.

Table 2. Percentage of annual change in the incidence of American Tegumentary Leishmaniasis from 2007 to 2015 in Rio Branco, Acre, Brazil.

	Coefficient	p-value	APC	(IC95%)	Interpretation
All	-0.0121	0.060	-2.76	(-5.60; 0.15)	Stationary
Sex					
Male	-0.0132	0.082	0.04	(-6.37; 0.50)	Stationary
Female	0.0002	0.993	-2.99	(-11.60; 13.23)	Stationary
Age group					
<1 Year old	0.0177	0.313	4.17	(-4.69; 13.88)	Stationary
1–41-4	-0.0739	0.256	-15.66	(-39.09; 16.7)	Stationary
5–9	-0.0286	0.334	-6.38	(-19.47; 8.82)	Stationary
10–14	0.0047	0.892	1.08	(-15.70; 21.22)	Stationary
15–19	0.0273	0.015	6.48	(1.67; 11.53)	Increase
20–34	-0.0727	<0.001	-15.41	(-18.57; -12.13)	Decline
35–49	-0.0387	0.019	-8.52	(-14.63; -1.97)	Decline
50–64	-0.0400	0.381	-8.80	(-27.77; 15.14)	Stationary
65–79	0.0006	0.997	0.14	(-25.15; 15.14)	Stationary
80 and +	-0.0520	0.554	-11.2	(-43.7 ; 39.8)	Stationary

APC: Annual Percent Change

The sum of new cases reported was 1,930 cases (90.3%) from 2007 to 2015. Relapses had a lower frequency of notifications in the same period, with 190 cases (8.8%). Considering the clinical form of ATL, most cases were in the cutaneous form, with 1,866 cases (87.4%) during the study period. While in the mucosal form, the sum between 2007 and 2015 was 269 cases (12.6%). In all the years studied, the cutaneous form had the highest number of diagnosed cases. Regarding the evolution of reported cases, most evolved to the cure stage, with 2,081 cases (97.4%) between 2007 and 2015. In the same period, there was a low frequency of treatment abandon, with 32 cases (1.4%). Only one case (0.04%) of death from ATL was found (in 2014).

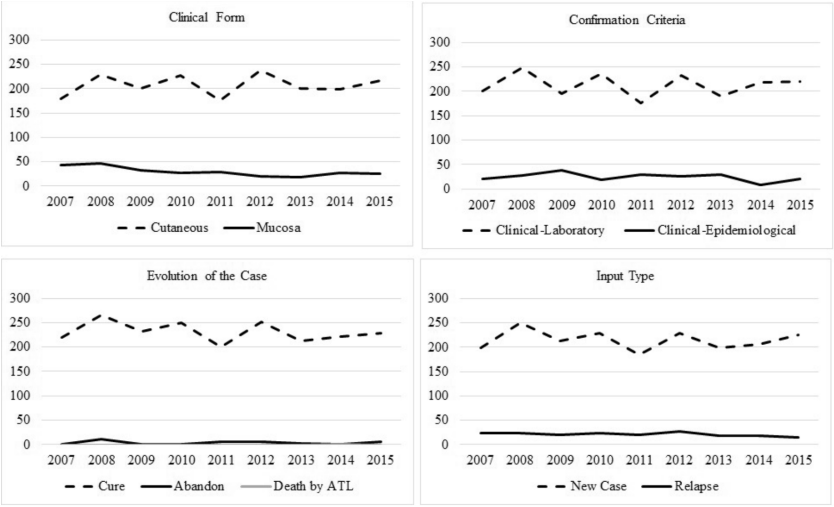

Figure. Number of cases by clinical form, confirmation criteria, evolution of the case and input type of American Tegumentary Leishmaniasis from 2007–2015 in Rio Branco, Acre, Brazil.

DISCUSSION

This study revealed details on the endemicity of all forms of ATL in Rio Branco from 2007 to 2015. The overall incidence of all forms of ATL remained stable over the study period. In the age group, there was a decline in the incidence of all forms of ATL in young adults. Conversely, in the 15-19 age group, there was an increasing trend in the incidence of all forms of ATL incidence. We infer that the trend of the high incidence of all forms of ATL observed during the study period may be related to the persistence of factors associated with ATL transmission in rural and riverside areas (Melchior et al., 2017). Also, the decrease in rural exodus may have contributed to the permanence of residents in these locations (Brilhante et al., 2017). As a result, human insertion in the disease transmission cycles was maintained.

The ATL epidemiological transmission profile in the city of Rio Branco is traditionally associated with wild cycles or locations near forest areas. However, in the State of Acre, the transmission profile changes to a domiciliary profile (Melchior et al., 2017). Thus, domiciliary or peridomiciliary transmission of all forms of ATL elucidates the occurrence of this disease among children and adolescents (Kawa & Sabroza, 2002; Tedesqui et al., 2012). The current phenomenon of the change from extractivism to livestock farming hampers the action of the disease vectors by transforming the forest into pasture and houses built away from the forest. This fact contributed to the decline in the incidence of all forms of ATL in the adult age group (Brilhante et al., 2017).

The greater exposure to certain occupational activities outside the home environment in part explains the increasing incidence of all forms of ATL in adolescents aged 15 to 19 years old and the higher occurrence in males rather than in women (Melchior et al., 2017; Almeida et al., 2018; Figueira et al., 2014). In rural areas, it is common to start working when they are adolescents. Also, the household and peridomiciliary transmission profile expose even more the adolescents to the disease. Another contributing factor may be related to leisure activities. An *in loco* observation showed that urban residents usually travel to rural areas during weekends and holidays to rest, visit parents, or even work in their small farms (Brilhante et al., 2017).

In the State of Acre, the direct parasitological laboratory method is the most commonly used procedure in the public health network (Almeida et al., 2019), enables a definitive diagnosis, is easy to perform and is inexpensive (Gontijo & Carvalho, 2003). Likewise, the clinical-laboratory criterion was used highly for confirmation of ATL cases in Rio Branco. Conversely, few cases were confirmed on the basis of clinical-epidemiological criteria. This fact reflects the wide availability of the tests to detect ATL by the primary health care in the city of Rio Branco.

Regarding the input type, the data showed a higher incidence of new cases and small recurrences. Thus, the permanence of disease transmission factors classified Rio Branco as an ATL transmission area (Melchior et al., 2017). Recently, the stable ATL incidence happened through control, diagnosis, and treatment initiatives. This context is directly attributable to the implementation of the Community Health Program in 2005, with the development of health initiatives for rural and riverside population in Rio Branco (Rio Branco, 2015). However, these initiatives have proved insufficient for controlling ATL.

The cutaneous form of ALT had the highest incidence than the mucosa form in the period between 2007 and 2015. This finding is similar to other high endemicity localities in the State of Acre (Melchior et al., 2017; Tedeschi et al., 2012; Oliart-Guzman et al., 2013). The cutaneous form is mainly caused by *Leishmania* species: *L. (Viannia) braziliensis* and *L. (Viannia) guyanensis* (Gontijo and Carvalho, 2003). In addition to these species, the human cases of ATL have been attributed to *L. (V.) shawi*, *L. (V) lainsoni*, and *L. (L) amazonensis* in Acre, thus indicating that infections with those species may lead to different clinical forms in the State (Brilhante et al., 2017).

From the cases of all forms of ATL reported during the study period, most evolved to cure. A low frequency of patients abandoned treatment between 2007 and 2015. This fact suggests that most patients followed the dosage and duration of treatment recommended by the primary healthcare team. Treatment success is associated with patient adherence to treatment and fast search for diagnosis and treatment, since the patient has the disease for a long time without treatment, the response for the treatment is low (Silva & Muniz, 2009).

In conclusion, the results revealed that Rio Branco is a high risk area for all forms of ATL transmission. During the study period, we identified a high incidence of the disease. Additionally, there was a trend toward an increase in the incidence of ATL in the younger age group. Also, there was a decrease in the incidence of ATL in the middle age group. Thus, we suggest implementing initiatives to control reservoir hosts and vectors in peri- and intra-household areas to reduce the number of all forms of ATL cases. Finally, residents of areas at risk of disease transmission should be encouraged to use personal protective measures based on their beliefs and customs.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest to disclose.

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