

ACUTE CHAGAS DISEASE IN THE 21ST CENTURY IN THE STATE OF PARÁ, EAST AMAZON, BRAZIL: THE NEW SCENARIO OF AN OLD DISEASE

DOENÇA DE CHAGAS AGUDA NO SÉCULO XXI NO ESTADO DO PARÁ,
AMAZÔNIA ORIENTAL, BRASIL: O NOVO CENÁRIO DE UMA DOENÇA
ANTIGA

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ABSTRACT

The objective of this study was to undertake a longitudinal and analytical investigation of acute Chagas disease (ACD) in the state of Pará, drawing upon cases documented between 2001 and 2021 within the Notifiable Diseases Information System (SINAN). A total of 5,856 cases of ACD were recorded in Brazil during this period, with 2003 showing the highest number of cases and 2008 the lowest. The state of Pará showed a significant increase in the number of cases, reflecting the change in the profile of the transmission of *Trypanosoma cruzi*, which is no longer vector-borne, but is now transmitted orally through the consumption of contaminated fresh food. The study revealed that, since 2007, the state of Pará has concentrated the majority of ACD cases in Brazil. Among the municipalities in the state of Pará with the highest average incidence of ACD per 100,000 inhabitants are Breves, Abaetetuba, Curralinho, Igarapé-Miri and Bagre. The incidence rates in these municipalities were more than 10,000% higher than the national average in the same period. Thus, we conclude that throughout the first decades of the 21st century, ACD occurred in the form of outbreaks affecting people of both sexes, living in rural and urban areas, after consuming food, especially açaí, contaminated by *T. cruzi*. These events make the regions of Marajó Island and the northeast of the state hotspots for the occurrence of ACD worldwide.

Keywords: *Trypanosoma cruzi*; Epidemiology; Tropical disease; Chagas disease; Amazon.

RESUMO

O objetivo deste estudo foi realizar uma análise longitudinal da doença de Chagas aguda (DCA) no estado do Pará, com base nos casos registrados entre 2001 e 2021 no Sistema de Informação de Agravos de Notificação (SINAN). Um total de 5.856 casos de DCA foi

registrado no Brasil durante esse período, sendo que 2003 apresentou o maior número de casos e 2008, o menor. O estado do Pará registrou um aumento significativo no número de casos, refletindo uma mudança no perfil de transmissão do *Trypanosoma cruzi*. A transmissão deixou de ser vetorial e passou a ocorrer por via oral, através do consumo de alimentos frescos contaminados. O estudo revelou que, desde 2007, o estado do Pará concentra a maioria dos casos de DCA no Brasil. Entre os municípios paraenses com as maiores taxas médias de incidência de DCA por 100.000 habitantes, destacam-se Breves, Abaetetuba, Curralinho, Igarapé-Miri e Bagre. As taxas de incidência nesses municípios foram mais de 10.000% superiores à média nacional no mesmo período. Conclui-se, assim, que ao longo das primeiras décadas do século XXI, a DCA ocorreu na forma de surtos que afetaram pessoas de ambos os sexos, residentes tanto em áreas rurais quanto urbanas, após o consumo de alimentos — especialmente o açaí — contaminados pelo *T. cruzi*. Tais eventos tornam as regiões da Ilha de Marajó e do nordeste do estado pontos críticos para a ocorrência de DCA em nível mundial.

Palavras-chave: *Trypanosoma cruzi*; epidemiologia; doença tropical; Doença de Chagas; Amazônia.

1. INTRODUCTION

Chagas disease (CD) is caused by *Trypanosoma cruzi* which affects more than 70 genera of mammals in Latin America. Despite this disease has been affecting humans for thousands of years in different Latin American countries (Ghul et al., 2014), the triad of agent, disease and vector was only understood at the beginning of the 20th century by Carlos Chagas (Malafaia; Rodrigues, 2010).

During the 20th century, CD was characterized by affecting people in poor areas of the Americas, and in 2005 CD was included in the list of neglected tropical diseases. Currently, CD is considered endemic in 21 countries, with Brazil being one of the world leaders (WHO, 2024).

The main vectors of *T. cruzi* are triatomines (Hemiptera:Reduviidae: Triatominae), and the main triatomines involved in the transmission in the Brazilian Amazon region belong to the genera *Rhodnius* and *Panstrongylus* (Barros et al., 2021).

Infection in mammals occurs mainly through contact with contaminated feces of these insects, either through skin lesions, mucous membranes, ingestion of the parasite, or by the ingestion of food contaminated (WHO, 2024).

The diagnosis of CD in humans in Brazil is mandatory, and the data is stored in the Notifiable Diseases Information System (SINAN) database, which is the source of research for establishing public policies to prevent and control this disease (Brazil, 2022).

Given the magnitude of CD in the state of Pará, we aim to carry out a longitudinal and analytical study of ACD recorded in Pará in the 21st century.

2. METHODOLOGY

A descriptive and retrospective observational study was carried out using data on ACD recorded between 2001 and 2021 in the SINAN.

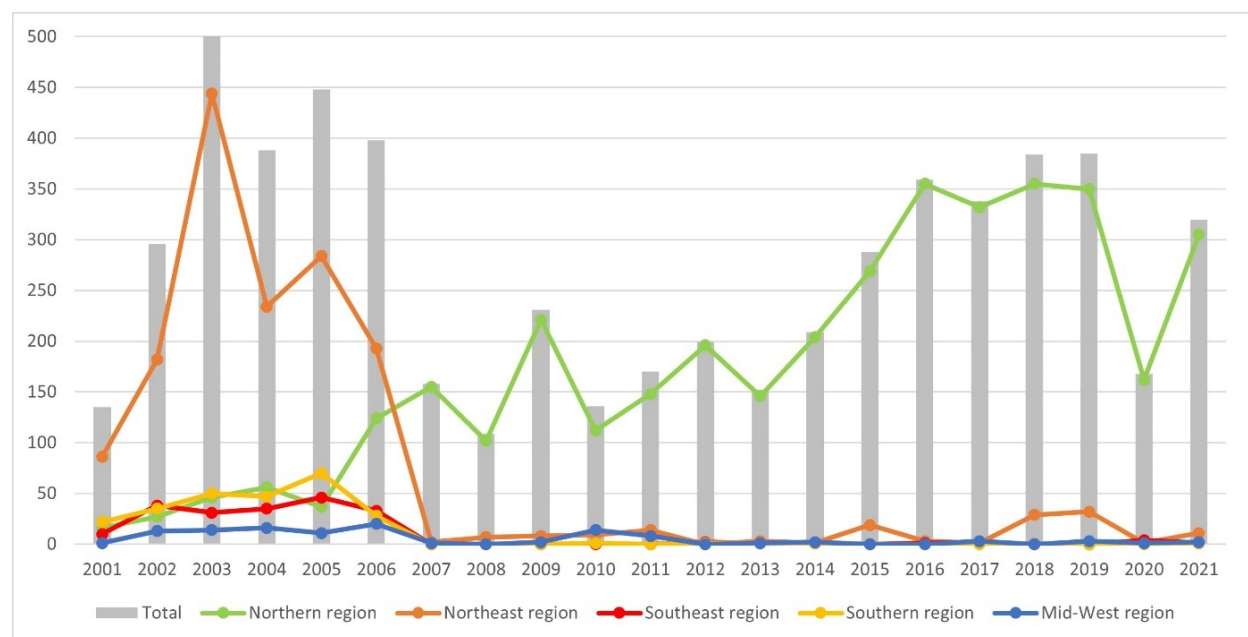
Information on the number of inhabitants per municipality in the region studied was collected from the Brazilian Institute of

Geography and Statistics (IBGE). The information obtained was then analyzed using descriptive statistics. An epidemiological map was constructed using the Mapschart software.

3. RESULTS

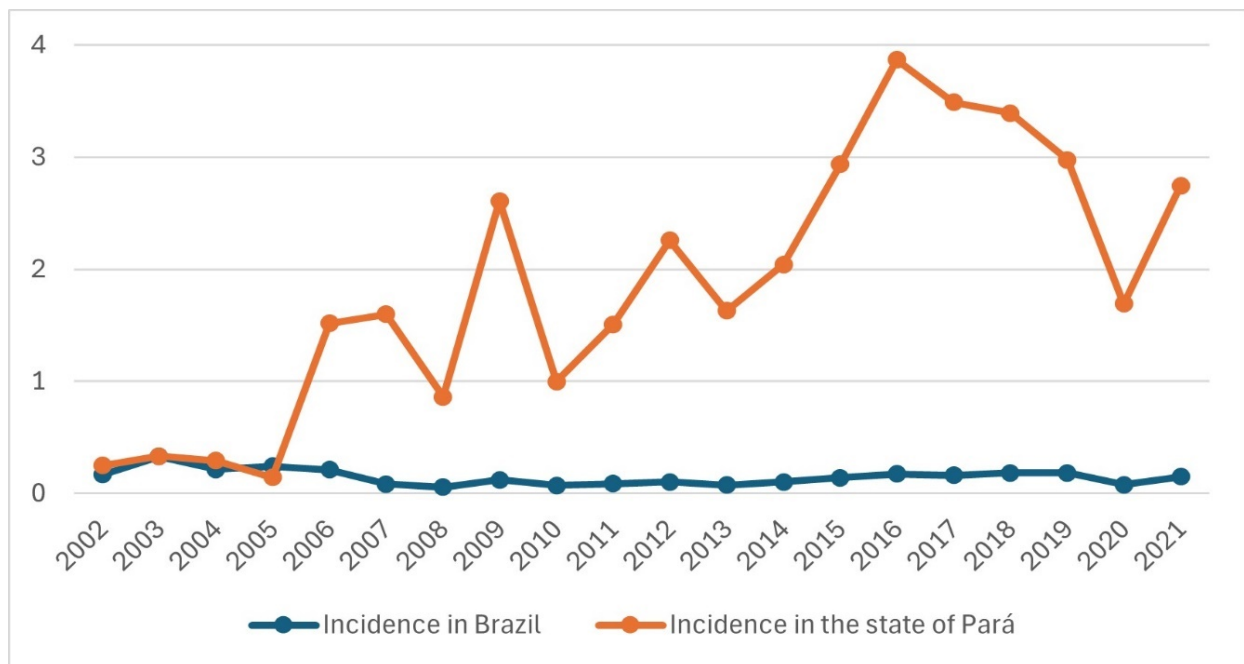
Brazil had a total of 5,856 cases of ACD between 2001 and 2021. The highest number of cases was recorded in 2003 (585), and the lowest in 2008 (109), as shown in figure 1.

Figure 1: Incidence of acute Chagas disease in Brazil according to geopolitical regions, between 2001 and 2021.



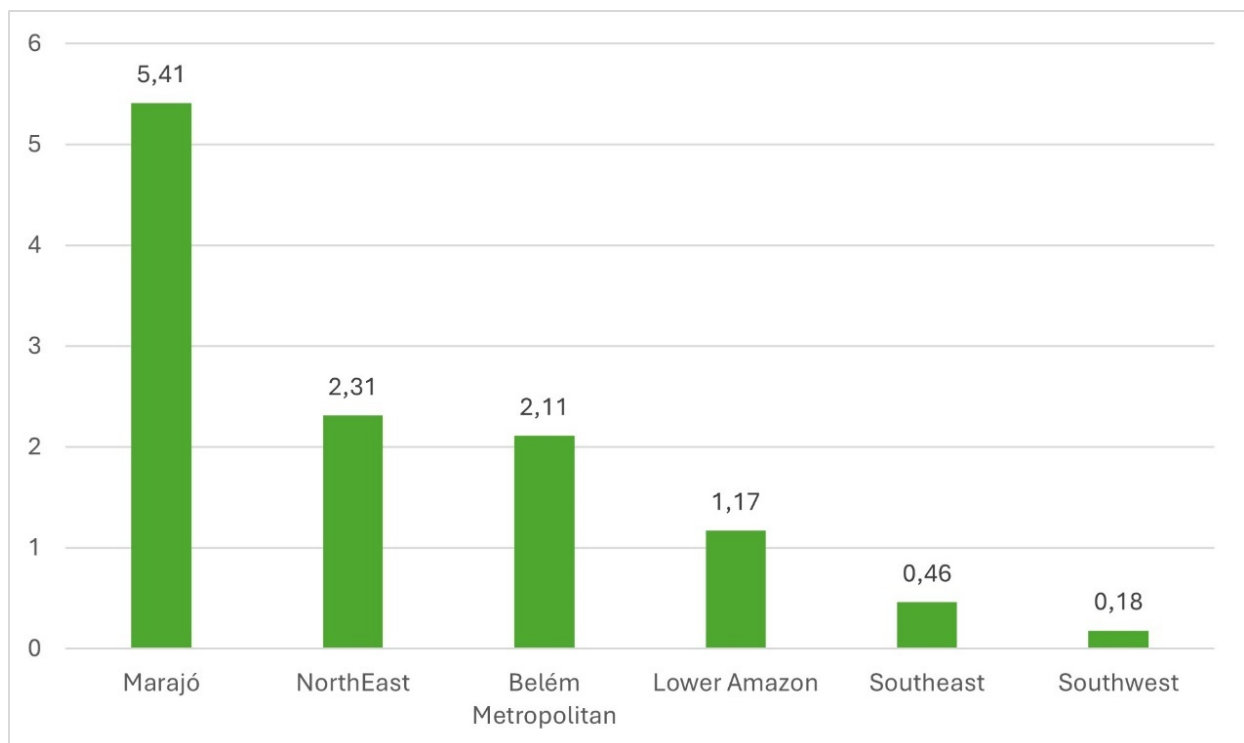
When comparing Brazil's geopolitical regions, the northern region has seen a significant increase in the number of reported cases over the period analyzed, and since 2007, the largest number of ACD notifications have come from this region. When we analyze the incidence of ACD cases per 100,000 inhabitants, excluding 2005, the incidence in Pará has always been higher than the national incidence (Figure 2).

Figure 2: Comparison of the incidence of acute Chagas disease per 100,000 inhabitants nationwide and cases from the state of Pará, from 2002 to 2021.



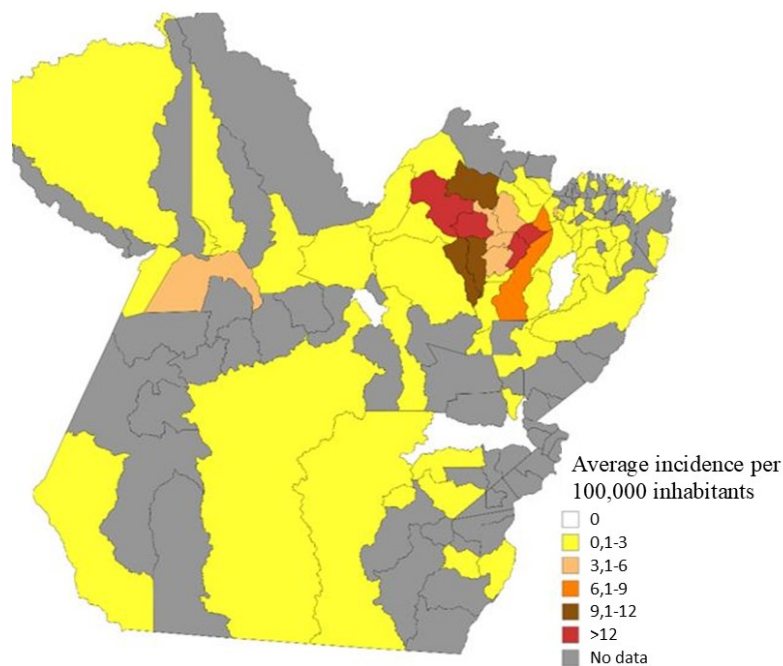
Among the regions of Pará, the Marajó region stands out as having the highest number of cases per 100,000 inhabitants (Figure 3).

Figure 3: Average incidence of acute Chagas disease per 100,000 inhabitants in the mesoregions of the state of Pará between 2001 and 2021.



Of the 144 municipalities in the state of Pará, in 43% (62/144) the average incidence was above the national average. In 4.8% (7/144) of the municipalities, the average incidence was equal to the national average, and in 2% (3/144) of the municipalities, the average incidence was below the national average. It is important to note that in 50% (72/144) of the municipalities there is no information on ACD in SINAN (Figure 4).

Figure 4: Epidemiological map illustrating the situation of municipalities in the state of Pará according to the average incidence of acute Chagas disease per 100,000 inhabitants between 2001 and 2021.



The most common form of transmission was the oral route with 2,269 cases recorded (79%), followed by the vector route with 179 cases (6.3%), the vertical route with 3 cases (0.2%) and in 408 cases (14.3%) it was not possible to determine the route of infection.

4. DISCUSSION

The absolute number of cases of ACD was similar between the first and second decade of the 21st century, however, there was a change in the origin of the cases, when most of them stopped coming from the northeast and started coming from the north of the country. This phenomenon has become more emphatic over the years, to the point where, in 2021, 95% (305/319) of registered cases came from the northern of Brazil, where the Amazon biome predominates.

This change in profile occurred probably as a result of *Triatoma infestans* control, which for many years was considered the main vector of *T. cruzi* in Brazil. The considerable reduction in human homes infestation rates by *T. infestans* since the beginning of the 21st century, led Brazil to receive certification from the Pan American Health Organization that transmission of *T. cruzi* by this vector had

been interrupted (Ferreira; Silva, 2006). It is worth noting that this certification did not represent effective control of the disease in Brazil, since this species of triatomine has not been eradicated from the national territory, and residual outbreaks have been recorded in different states such as Bahia (Brandão et al., 2015), Rio Grande do Sul (Belisário et al., 2017) and Espírito Santo (De Oliveira et al., 2021).

In the year following the interruption of *T. cruzi* transmission by *T. infestans* in Brazil, there was a sharp drop in the number of ACD registered in Brazil. This was due to the absence of cases in the south, central-west and southeast regions, as well as the sharp drop in cases from the northeast region, which fell from 193 in 2006 to two cases in 2007. On the other hand, there was an increase in cases from the northern region, which has since become the region with the highest number of cases registered annually in Brazil. This can be explained by the existence of several species of autochthonous triatomines such as those of the genus *Rhodnius* (Brazil, 2024).

Among the more than 60 species of triatomines described in Brazil, the species of the genus *Rhodnius*, which are abundant in the Amazon biome, stand out for inhabiting the peridomicile and being attracted to the intradomicile during the night by artificial light, thus making their control more difficult. *Rhodnius robustus* and *Rhodnius pictipes* were considered the main vectors of *T. cruzi* in an endemic area in the state of Pará, due to their abundance and high infection rates (Barros et al., 2021).

ACD is historically frequent in the Brazilian Amazon, in a study of 233 cases of ACD from this region, between 1988 and 2005, it was observed that there was a tendency for outbreaks to occur in both urban and rural areas (Pinto et al., 2008).

When analyzing the ACD from the northern region, the increase in cases is striking, from 16 registered in 2001 to 305 cases in 2021, representing an increase of 1,900%. This happened due to cases originating in the state of Pará, which went from zero in 2001 to 241 cases in 2021. It's important to note that at the beginning of the 20th century, the state of Pará had a low level of computerization and internet access, especially in the municipalities located in the most remote areas, making it difficult to feed SINAN correctly.

In addition to the difficulty of feeding the SINAN, we cannot ignore the lack of qualification of health professionals to diagnose ACD. To justify this idea, we can use the fact that in 2020, 29,003 tests were requested for the diagnosis of DC throughout Brazil, however, only 2,834 of these requests came from the Northern region (Brazil, 2022). Given this context, we need to consider the possibility of historical underreporting of ACD, especially in the first decade of the 21st century.

The importance of ACD in the state of Pará becomes more evident when we look at the incidence per 100,000 inhabitants. The municipalities in the state of Pará with the highest average incidence of ACD per 100,000 inhabitants were Breves (17.49), Abaetetuba (14.12), Curralinho (14.03), Igarapé-Miri (13.12) and Bagre (10.3). These incidences are alarming as they represent more than 10,000% above the national average for the same period, which was 0.14. These figures indicate that this region is considered a hot spot for ACD, and that it deserves the full attention of the health authorities.

Formerly considered rare (Barbosa, 2006), oral transmission of *T. cruzi* has emerged as the main route of infection of people in the

early 21st century in Brazil. This has already been reported by other researchers, especially in the Brazilian Amazon (Shikanai-Yasuda; Carvalho, 2012; Santana et al., 2019; De Sousa et al., 2023) and is striking when analyzing the SINAN data. This route is strongly associated with the ingestion of food contaminated by the feces of an infected triatomine, and is responsible for changing the classic epidemiological scenario of the disease with the emergence of outbreaks in both rural and urban areas (De Sousa et al., 2023).

According to data published in 2015 by the Ministry of Health (Brazil, 2015), the vast majority of oral infection are recorded in the state of Pará, and there are many records of ACD outbreaks associated with the consumption of açaí pulp (Santana et al., 2019; De Sousa et al., 2023). A clear association has been observed between the açaí harvest period, which is a food produced and consumed on a large scale in the state of Pará, and the occurrence of ACD outbreaks. Contamination of açaí by *T. cruzi* can occur when triatomines are crushed during the processing of the fruit pulp, since the açaí palm can be home to *Rhodnius* (Valente et al., 2009), and the presence of the insect is not identified between harvesting the fruit and processing it into food.

Thus, as we move forward in this century, the reduction of ACD in Brazil depends on the continued use of integrated public health strategies to mitigate cases from the state of Pará. These strategies must provide the training of people who work in the açaí production chain, including the training of health professionals to upgrade the accuracy of medical diagnosis, as well as promoting the improvement of disease records in SINAN.

5. CONCLUSION

We concluded that throughout the first decades of the 21st century, ACD occurred in the form of outbreaks affecting people of both sexes, living in rural and urban areas, after consuming food, especially açaí, contaminated by triatomine feces with *T. cruzi*. These events make the mesoregions of Marajó Island and the northeast of the state of Pará hotspots for the occurrence of ACD worldwide.

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Conflict Of Interests

The Authors Declare That They Have no Known Competing Financial Interests or Personal Relationships That Could Have Appeared to Influence The Work Reported in This Paper.

Ethical Statement

The Method Used in This Study Was Based On The Analysis of Data Available in a Database That is Freely Accessible To The Public And Complies With The Rules of Ethics In Scientific Research.

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