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EPIDEMIOLOGICAL PROFILE OF CHAGAS DISEASE IN BELÉM DO PARÁ: A DESCRIPTIVE AND RETROSPECTIVE STUDY BETWEEN 2010 AND 2020

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Abstract: Chagas disease, caused by the protozoan *Trypanosoma cruzi*, is a relevant neglected disease in Latin America, contributing to Disability-Adjusted Years of Life Lost (DALYs). This anthropozoonosis has two clinical phases, acute and chronic, influenced by genetic interactions, environmental and social factors. In the North region, its epidemiology is influenced by the presence of transmitting kissing bugs, geographic distribution of *T. cruzi*, socioeconomic and environmental conditions and limited access to health services. Therefore, this study sought to outline the epidemiological profile of Chagas disease in Belém do Pará, carrying out a descriptive and retrospective analysis between 2010 and 2020. The data were obtained from the Department of Informatics of the Unified Health System (DATASUS) through the Information System Information on Notifiable Diseases (SINAN). Of the 289 cases reported, 2011 was the year with the highest occurrence, with 72 cases (24.2%). Of the total cases, 158 were associated with males (54.7%) and 131 with females (45.3%). The most affected age group was those between 40 and 69 years old, with 170 cases (58.8%). Brown people were the most affected by the disease, with 168 cases (58.1%), followed by white people (9.3%), black people (4.8%) and indigenous people (0.3%). The oral route was the most recorded route, with 186 of the cases (64.3%), followed by the vector route (1.7%) and accidental route (0.3%). Of the total cases, 11 cases were reported with death resulting from CD (3.8%) and 3 deaths from other causes (1%). Finally, the epidemiological profile of Chagas disease in the city of Belém does not seem to differ from the rest of Brazil, demonstrating that there is still a need for greater attention to the epidemiology of the disease, with more intense surveillance in regions endemic for the occurrence of the parasite vector, as well as the

handling of food that may be contaminated.

Keywords: Chagas disease, *Trypanosoma cruzi*, Trypanosomiasis, Epidemiology, Amazon, Public Health.

INTRODUCTION

Chagas disease (CD), caused by the protozoan *Trypanosoma cruzi*, is a parasitic, systemic, chronic and potentially fatal disease (MARTIN-ESCOLANO FR, et al., 2022). It was discovered by physician-researcher Carlos Justiniano Ribeiro das Chagas in 1909, in the state of Minas Gerais, when observing the blood fluid of a two-year-old girl suffering from an acute illness (VASCONCELOS, 2013). Later, Carlos Chagas also described its main transmitters, the hematophagous triatomine vectors, popularly known as kissing bugs (CHAGAS, 1909).

T. cruzi has a commonly western distribution, being transmitted by vectors that occur from the south of the United States to Argentina, with more than 100 vector species, which are directly associated with household transmission (SCHMUNIS, 1997). Despite this, its occurrence goes beyond its geographical limits, with records in Canada, Europe and some countries in the east of the Pacific (COURA JR and VIÑAS PA, 2010), transmitted by non-vector routes.

Even after more than a century since its discovery, CD continues to be a strong public health problem in Latin America, marked by the typical organic injury generated by human actions (VINHAES MC and DIAS JCP, 2000), which permeate its bioecological context, going from an interaction restricted to the wild environment to a heteroxenic relationship, which involves the human host (DIAS, 2007).

America trypanosomias is is then configured as an anthropozoonosis characterized by two clinical phases, modulated by genetic interactions and environmental and social factors, with an acute phase characterized by high parasitemia, accompanied by fever, malaise and headache, sometimes presenting symptoms nonspecific, and a chronic phase, whose clinical picture presents more specific symptoms, such as hepatosplenomegaly, myocarditis, meningitis, adenomegaly, among others (CAMPBELL DA, et al., 2004).

Although CD has a spatial distribution initially limited to the American continent, chagasic infection occurs in non-endemic countries, being related to the intense process of international migration, with non-vector transmission (STRASEN J, et al., 2014). According to the World Health Organization (1991), it is estimated that around 17 million people are infected by the parasite and 88 million are at risk of contamination.

Furthermore, CD was the main contributor to disability-adjusted life years (DALYs) among neglected diseases in South America (MARTINS-MELO FR, et al., 2018). The predictions are that there will be around 4.6 million people affected by the disease in Brazil, with an estimate of just over 1 million people infected by *T. cruzi* (MARTINS-MELO FR, et al., 2014). It is worth considering that of these, approximately 60% of infected people remain asymptomatic, and between 10% and 30% progress to chronic disease.

Despite the intense demographic, social and environmental transformations occurring in Brazil, socioeconomic and regional differences expose a large part of the population to CD infection, expressing strong social inequality (VICTORA CG, et al., 2011), a fact that can influence the epidemiology of the disease, demonstrating a certain negligence towards the control of CD in Brazil.

It is worth considering that between 2005 and 2009, confirmed cases of CD in Brazil totaled around 699 cases, associated with oral transmission. Of these, 605 occurred in the northern region, with 536 diagnosed

in the state of Pará (BRAZIL, 2010). Such occurrences emerged in the form of an outbreak associated with the seasonal period of açaí, the main source of contamination by *T. cruzi*, which presents a high risk of storing protozoa, making it possible to transmit them orally (ANDRADE JKS, et al., 2020).

Therefore, the epidemiology of Chagas disease in the North region can be influenced by several factors, including the presence of species of kissing bugs that transmit the disease, the geographic distribution of *Trypanosoma cruzi*, socioeconomic and environmental conditions and the lack of access to health services. adequate health. Given this, considering that the epidemiological profile of the disease depends on the socioeconomic and geographic characteristics of the region, the initial proposal of the work is to trace, retrospectively, the epidemiological profile of CD in the city of Belém, in the state of Pará, between the years 2010 and 2020.

METHODS

Despite the prevalence of the chronic form, only acute cases are mandatory notification in the Notifiable Diseases Information System (SINAN). Therefore, a retrospective, documentary and historical study was carried out that collected data on acute CD in Belém do Pará between the years 2010 and 2020. The epidemiological data were obtained from the database of the Department of Informatics of the Unified Health System - DATASUS, using the "Notifiable Diseases Information System" form (SINAN).

The data included the incidence of the disease by year, sex, age group, race, probable mode of infection and disease evolution. With this, the incidence rate (I) of CD was calculated using the formula: number of new reported cases of the disease divided by the population residing in the location, and the result was multiplied by 100 thousand inhabitants. This incidence rate represents the number of cases of the disease per 100 thousand inhabitants in that population and specific period. As for the prevalence rate (P) of CD, the equation followed cases of the variable under analysis (Y) per hundred, then dividing the result by the total number of cases.

$$I = \frac{Number\ of\ cases}{Resident\ populatione}\ x\ 100.000$$

$$P = \frac{(Yx100)}{Total\ number\ of\ casess}$$

The data analysis method was through descriptive statistics, using Excel 2016 and GraphPad Prism version 8 software as statistical tools. As this is a descriptive study, specific literature was selected, whose characteristics presented study objectives and year of publication that outlined the epidemiological profile of the disease in the northern region of Brazil, in order to compare with the information collected in this study.

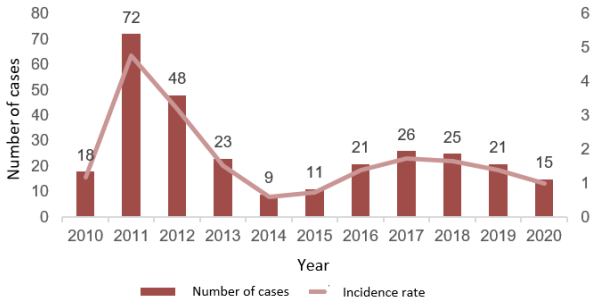
Data analysis was performed to establish the disease occurrence profile and provide possible explanations for statistical variations in notification. It is important to note that this study was based only on cases of acute CD, since only the acute form of the disease is mandatory notification in the country, through SINAN, and there are no records of the chronic form in the DATASUS databases.

It is worth considering that, in accordance with Resolution number. 580/2018 of the National Health Council, as it is a descriptive/ retrospective study that makes use of secondary data publicly disclosed by the aforementioned sources, the research does not require acceptance from the Research Committee. Research Ethics.

RESULTS

In the study, 289 confirmed cases of Chagas disease were analyzed in Belém, with a higher incidence and prevalence in 2011, with I=4.8 and P=24.9% (graph 1). Furthermore,

between 2012 and 2014 there was a significant decrease in the number of cases, with a small increase in the following years.



Graph 1: Incidence rate and number of CD cases between 2010 and 2020.

Source: Corrêa APC, et al. 2023; data extracted from SINAN.

The high rates of occurrence of CD in the North Region, from the 90s onwards, brought to light a major public health problem in the Amazon, with high incidence rates for the state of Pará (BRAZIL, 2020), being highlighted in the study by Parente MF, et al. (2020) a significant increase in the occurrence of CD in 2010, with emphasis on the city of Belém, as highlighted in the present study.

Such inferences may be associated with the high consumption of açaí during this period, marked by the increase in its market value due to its export, leading the population to seek out the food in clandestine artisanal mixers, without sanitary inspection, which could possibly be contaminated. (LIMA AJS, et al., 2021). Santos VRC, et al. (2018), also point out that the increase in cases in urban areas, such as the city of Belém, was accentuated due to the lack of supervision in the production of açaí.

It is worth considering that the drop-in cases from 2012 onwards may be associated with the creation of the State Açaí Quality Program, object of State Decree number 2,475/2010 and decree number 326 of 2012, guided by the high productivity of açaí in clandestine slaughterhouses (BRAZIL, 2011).

Regarding the gender variable, the data demonstrated a higher prevalence in male individuals with 54.7% of cases. However, between 2011 and 2012, the highest incidences were associated with women, with 30.5% and 20.6% respectively (table 1). Furthermore, the results analyzed showed that those affected by CD are generally people aged between 40 and 64 years old, with a prevalence of 58.7% in the study.

		Year											Total
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Gender	Male	12	32	21	16	3	6	13	16	15	14	10	158
	Female	6	40	27	7	6	5	8	10	10	7	5	131
Age	<1 ano	-	<1 year	-	1	-	1	-	-	1	-	6	
	5 a 9	-	5 to 9	-	-	1	-	-	1	1	1	5	
	10 a 14	1	10 to 14	1	1	1	-	1	2	1	-	13	
	15 a 19	1	15 to 19	2	-	1	2	1	1	3	-	15	
	20 a 39	7	20 to 39	1	2	1	1	11	1	4	-	39	
	40 a 59	2	40 to 59	7	1	3	8	10	7	3	8	86	
	60 a 64	2	60 to 64	11	3	3	6	-	8	6	5	84	
	65 a 69	3	65 to 69	-	-	-	1	3	3	2	-	21	
	70 a 79	-	70 to 79	1	-	1	1	-	1	-	1	8	
	80 >	2	80 >	-	1	-	1	-	1	-	-	12	

Table 1: Confirmed cases of acute Chagas Disease according to sex and age group, between 2010 and 2020.

Source: Corrêa APC, et al. 2023; data extracted from SINAN. (-) no record of occurrence

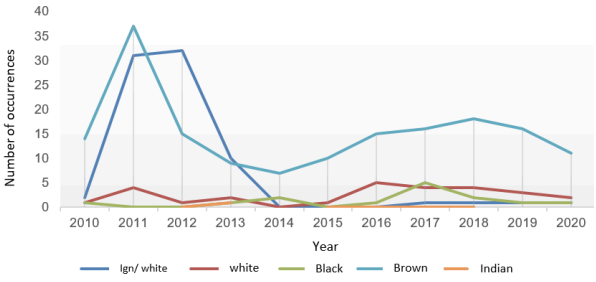
The same percentage was found in the study by Souza SB, et al. (2021), with a higher incidence of Chagas disease in males. Furthermore, in the same study the highest occurrence values were associated with ages between 20 and 59 years of age. Other studies also demonstrate a greater occurrence of the disease in males aged between 20 and 59 years (BOZELLI CE, et al., 2006; CUTRIM FSRF, et al., 2010; LIMA AJS, et al., 2021; CARDOZO EJS, et al., 2017; SILVA GG, et al., 2020; SANTOS FAC, et al., 2020), indicating that the epidemiology of the disease is strong among adult males.

According to Cutrim FSRF, et al. (2010), the highest occurrences in men are due to wild transmission, since it is men who tend to take care of hunting and farming, exposing themselves to the disease vector. However, in this study there are no indications of

anthropozoonotic interaction, since the likely mode of infection occurred via another route.

Additionally, recent studies carried out on other trypanosomatids indicate a strong influence of sex on the development of the pathology, influenced by differences in hormonal conditions between men and women, which interact with the immune system (LOCKARD RD, et al., 2019). However, in *T. cruzi* there is no evidence that hormonal or genetic conditions are involved in the greater propensity of men to develop the disease, leading to this hypothesis being discarded.

With regard to race/color, there was a higher prevalence in brown people, with an absolute frequency of 168 of the confirmed cases (58.1%), followed by white race/color (9.35%), black (4.8%) and indigenous (0.5%). Cases ignored regarding race/color were common in 79 cases (27.3%) (graph 2).



Graph 2: Prevalence rate of confirmed cases of Chagas disease according to the race/color variable.

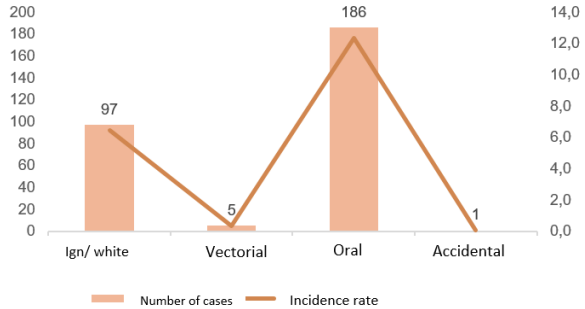
Source: Corrêa APC, et al. 2023, data extracted from SINAN.

Several academic studies have already demonstrated a higher occurrence of Chagas disease in brown people (ALENCAR MMF, et al., 2020; CARDOSO LP, et al., 2020; FELIX EBG, et al., 2020; SILVA GG, et al., 2020; OLIVEIRA SS, et al., 2021; SOUZA SB, et al., 2021; VILHENA AO, et al., 2020), demonstrating that the epidemiological profile in that city does not differ from the rest of Brazil. Such inferences are associated with the self-declaration of the Brazilian population regarding their skin color, where around 76.5% of the population declared themselves black and/or mixed race (IBGE, 2010).

Furthermore, according to Pearce N, et al. (2004), ethnic-racial inequalities in health in Brazil are associated with socioeconomic differences, which expose a large part of the population to poor living and health conditions, leading to their own effects on health.

It is important to consider that according to Couto-Silva CM, et al. (2023), the low incidence of Chagas disease among indigenous populations in the Amazon can be attributed to a genetic variant, found in the majority of individuals analyzed in the region, which possibly plays a significant role in resistance to infection by the parasite that transmits the disease.

For the probable mode of infection variable, the results showed a higher occurrence associated with the oral route of infection, with a prevalence of 65.4% and an Incidence Rate of 12.3%, followed by the vector route (1.7%) and accidental (0.3%). Ignored or blank data made up 33.5% of cases (graph 3). Such prevalence of oral infection may be associated with the ingestion of improperly processed or unprocessed foods contaminated with *T. cruzi*.



Graph 3: Confirmed cases of acute Chagas Disease according to year and probable mode of infection, between 2010 and 2020.

Source: Corrêa APC, et al. 2023, data extracted from SINAN

The oral transmission of *T. cruzi*, in short, is linked to the customs of the Pará population of consuming açaí, the main fruit cultivated to guarantee the survival of riverside and low-income families in the region. However, the preparation of açaí is often not done with due care, leading to contamination. This consideration is well outlined by Lima AJS, et al. (2021) when describing that the highest occurrences of CD in the North Region between 2011 and 2019 were associated with the açaí harvest months.

Changes in the epidemiological patterns of disease transmission, previously linked to the vector route, are the result of control actions undertaken in recent decades, along with environmental, demographic, economic and social changes, as well as the migration of people to urban areas (DIAS JCP, et al., 2016).

Furthermore, the oral route is considered a primary mechanism, especially in the sylvatic cycle, and will continue to occur independently of control actions (BRAZIL, 2014).

Of the 289 cases analyzed, 89.9% of people who reported the occurrence of the disease did not show any progression of the disease, with 3.8% progressing to death due to the reported condition. The remaining cases of death were not associated with *T. cruzi* infection (table 2).

Variabl		Year											
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
	Ign/ white	1	3	3	2	-	1	3	1	-	-	1	15
	Alive	15	64	44	19	8	10	18	24	24	20	14	260
Evolution	Death due to notified grievance	1	3	1	2	1	-	-	1	1	1	-	11
	Death from another cause	1	2	-	-	-	-	-	-	-	-	-	3

Table 2: Confirmed cases of acute Chagas Disease according to year and evolution of the disease, between 2010 and 2020 in Belém.

Source: Corrêa APC, et al. 2023, data extracted from SINAN (-) **no record of occurrence**

Similar results were recorded in the works of Parente MF, et al. (2020), Macêdo TLS, et al. (2021) and Padre JGP, et al. (2020), pointing out late notification as the main cause. Furthermore, the acute phase of CD does not present specific manifestations and may go unnoticed in terms of its diagnosis, which leads to a reduction in reported cases, with consequent progression of the disease to the chronic phase and finally progression to death.

It is worth considering that, as indicated by Vilhena AO, et al. (2020), the high mortality rates resulting from Chagas disease in Belém do Pará are due to the city serving as the main hospital hub for CD cases, justifying the high rates of CD notification.

CONCLUSION

The present study described the epidemiological profile of Chagas disease in the city of Belém, Pará between 2010 and 2020, pointing to a greater occurrence of the disease in 2011, with a noticeable drop from 2012 onwards, probably associated with the creation of the State Açaí Quality Program in 2010. Furthermore, the increase in the incidence rate in 2011 seems to be in line with the period in which the demand for açaí intensified in clandestine establishments. The prevalence of the disease in male individuals aged between 40 and 64 years is in line with different studies carried out in Brazil, ensuring that it is not a particular characteristic of the epidemiological profile found in the city of Belém. Finally, the epidemiological profile of Chagas disease in the city of Belém does not seem to differ from the rest of Brazil, demonstrating that there is still a need for greater attention to the epidemiology of the disease, with more intense surveillance in endemic regions for the occurrence of the parasite vector, as well as on the handling of foods that can be contaminated.

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