ORIGINAL ARTICLE

Community knowledge about Chagas disease in a municipality in Northeast of Brazil

Conhecimentos da comunidade sobre a doença de Chagas em um município do Nordeste do Brasil

Elainne Silva Freire [1], Alison do Nascimento Lima[2], Antônio Marcos Alves Cadeira Lima[2], Isabela Resende Ávila[3], Ana Carla Silva Jansen[1], Aline do Carmo Silva[1], Juliana Maria Trindade Bezerra[1,4,5]

1 Programa de Pós-Graduação em Ciência Animal, Centro de Ciências Agrárias, Universidade Estadual do Maranhão (UEMA), São Luís, Maranhão, Brasil. 2 Curso de Licenciatura em Ciências Biológicas, Universidade Estadual do Maranhão (UEMA), Campus Lago da Pedra, Lago da Pedra, Maranhão, Brasil. 3 Departamento de Saúde Coletiva (DSC), Faculdade de Ciências da Saúde (FS), Universidade de Brasília (UnB), Brasília, Distrito Federal, Brasil. 4 Programa de Pós-Graduação em Parasitologia, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, Minas Gerais, Brasil. 5 Departamento de Química e Biologia, Campus Caxias, Universidade Estadual do Maranhão (UEMA), Caxias, Maranhão, Brasil.

Abstract

Objective: this study aimed to assess community knowledge about about Chagas disease in the municipality of Lago dos Rodrigues, state of Maranhão, Northeast of Brazil. **Methods**: a questionnaire containing 20 multiple-choice questions was administered to 263 participants, and their sociodemographic data were also analyzed. **Results**: study participants demonstrated a limited and fragmented understanding of aspects related to disease prevention, transmission, etiological agent, and vector, revealing important gaps in the comprehension of these elements. **Conclusions**: the population's knowledge in Lago dos Rodrigues showed statistically significant associations with social factors. Although a large proportion of the population recognizes the disease vector, incorrect conceptions regarding the etiological agent, transmission routes, and preventive measures for this parasitosis.

Keywords: Chagas disease; knowledge; health education; Maranhão.

Resumo

Objetivo: este estudo teve como objetivo avaliar o conhecimento da comunidade sobre a doença de Chagas (DC) no município de Lago dos Rodrigues, estado do Maranhão, Nordeste do Brasil. **Métodos:** Um questionário contendo 20 questões de múltipla escolha foi aplicado a 263 participantes, e seus dados sociodemográficos também foram analisados. **Resultados**: os participantes do estudo demonstraram um entendimento limitado e fragmentado de aspectos relacionados à prevenção, transmissão, agente etiológico e vetor da doença, revelando lacunas significativas na compreensão desses elementos. **Conclusões**: o conhecimento da população de Lago dos Rodrigues apresentou associações estatisticamente significativas com o nível social. Assim, embora grande parte da população reconheça o vetor da doença, persistem concepções incorretas quanto ao agente etiológico, às vias de transmissão e às medidas preventivas para essa parasitose.

Palavras chave: doença de Chagas; conhecimento; educação em saúde; Maranhão.

INTRODUCTION

Chagas disease (CD), caused by the parasite *Trypanosoma cruzi* (Chagas, 1909), is a zoonosis of public health importance and is classified as a neglected tropical disease[1]. According to the Pan American Health Organization (PAHO), it is estimated that approximately six to eight million individuals are infected with CD in the Americas, with about 30,000 new cases and 14,000 deaths reported annually[2].

In Brazil, this parasitosis presents an annual average of 332.4 cases per 100,000 inhabitants, considering only the acute form of the disease. Between 2006 and 2023, 4,560 acute cases were confirmed in the country, with predominance in the North region (4,321 cases), followed by the Northeast region (163 cases)[4]. In parallel, between 2016 and 2020, 31,342 deaths attributed to chronic Chagas disease (CCD) were recorded, highlighting the substantial mortality burden associated with this phase of the disease[3]. Oral and vector-borne transmission are the main routes of infection and have contributed to the increase in the number of reported cases in recent years[5]. The disease dynamics in areas of the Brazilian Legal Amazon are influenced by deforestation, frequent contact with vectors, and the improper handling of foods such as açaí and sugarcane, which contribute to the maintenance of the endemicity of this parasitosis[6,7].

The Northeast region accounts for approximately 65% of the

Correspondence: Juliana Maria Trindade Bezerra. Departamento de Química e Biologia, Campus Caxias, Universidade Estadual do Maranhão. Praça Duque de Caxias, s/n, Morro Alecrim, CEP: 65.604-380, Caxias, Maranhão, Brasil. E-mail: julianabezerra@professor.uema.br
Conflict of interest: There is no conflict of interest on the part of any of the authors.
Received: 2026 Jan 24; Revised: 2026 Feb 20; Accepted: 2026 Mar 9

reported cases of acute Chagas disease (ACD), reflecting the persistence of residual transmission foci in both urban centers and rural areas[7,8]. In the state of Maranhão, the persistence of the zoonosis has been evidenced by outbreaks associated with the consumption of contaminated food[6,8]. A notable episode occurred in 2017 in the municipality of Pedro do Rosário, located in the western mesoregion of the state, where the consumption of contaminated bacaba juice resulted in 39 confirmed cases[8]. Epidemiological data recorded between 2008 and 2018 indicate that the incidence of the parasitosis in this municipality reached 9.27 cases per 100,000 inhabitants[6].

The persistence of CD, particularly in its chronic phase, is intrinsically linked to complex socioeconomic and structural factors, including precarious housing conditions, inadequate basic sanitation, low levels of education, and limited access to health services[3]. In this context, investigating population knowledge represents a fundamental strategy to support health education actions and strengthen public health policies, especially in small municipalities located in endemic areas[3]. Therefore, the present study aimed to evaluate community knowledge about CD in the municipality of Lago dos Rodrigues, state of Maranhão.

METHODS

Study area

The study was conducted in the municipality of Lago dos Rodrigues, state of Maranhão, Northeast of Brazil, located in the Central Maranhão mesoregion and the Médio Mearim microregion. The municipality has a territorial area of 220.776 km^2 and is located at the geographic coordinates 4° 36′ 09″ S latitude and 44° 59′ 02″ W longitude. In 2022, the population was 8,858 inhabitants, with a population density of 39.67 inhabitants per km^2. The municipality borders Lago do Junco and Igarapé Grande to the north, Poção de Pedras to the south, Igarapé Grande to the east, and Lago do Junco to the west[9].

According to the *Instituto Brasileiro de Geografia e Estatística* (IBGE), the municipality of Lago dos Rodrigues presented a schooling rate of 99.3% among individuals aged 6 to 14 years, based on indicators from the 2022 Demographic Census[10]. With regard to the socioeconomic context, the municipality recorded a *Índice de Desenvolvimento Humano Municipal* (IDHM) of 0.602, according to census data from 2010[11].

Data collection

This is an observational, cross-sectional study[12] to determine the community knowledge about CD in the municipality of Lago dos Rodrigues, state of Maranhão. Individuals aged 18 years or older were approached on 19 public streets in the municipality, distributed across the Pimentel and Centro neighborhoods. Participants were recruited according to their availability to participate, characterizing a convenience sample.

Data were collected by three trained interviewers between August 3, 2022, and July 20, 2023, using a standardized closed-ended questionnaire. When necessary, interviewers provided clarifications to facilitate participants' understanding, without modifying the wording or content of the questions.

The questionnaire was divided into two sections: (i) nine questions regarding sociodemographic characteristics, including sex, age, education level, race, household income, number of residents in the household, number of rooms in the residence, type of housing, and occupation; and (ii) 20 multiple-choice questions related to aspects of CD. Each question contained several answer choices, of which only one was considered correct, in addition to the option "I do not know". The number of alternatives varied among questions according to the nature of the information being assessed. For statistical analyses, only selected questions that assessed specific knowledge about the etiological agent, transmission routes, vector, and preventive measures were included, as they were considered appropriate for quantitative analysis. The complete questionnaire used in this study is available in Supplementary Material 1.

The questions and their respective correct answers are: "Do you know what agent is responsible for causing Chagas disease?" Correct answer: protozoan parasite. "What is the name of the causative agent of Chagas disease?" Correct answer: *Trypanosoma cruzi*. "Do you know how Chagas disease is transmitted?" Correct answer: by the vector insect, which, during blood feeding, can eliminate feces containing the etiological agent at the site of the bite, as well as by ingesting contaminated food. "What transmits Chagas disease?" Correct answer: insect (kissing bug). "What measures do you consider effective to avoid contracting Chagas disease?" Correct answer: use of repellents and mosquito nets, prevention of the formation of insect colonies in homes, and avoiding the consumption of food contaminated with feces from infected kissing bugs.

The data obtained from the questionnaires were organized in spreadsheets using Microsoft Excel (Washington, United States of America) and were expressed as absolute and relative frequencies.

Statistical analysis

Contingency tables were constructed to evaluate associations between categorical variables. In each table, independent variables (sex, age group, educational level, race, and household income) were cross-tabulated with dependent variables (responses regarding the causative agent of CD, transmission aspects, and prophylaxis), and Pearson's chi-square test (χ^2) was applied. The "I do not know" response option was structured as a valid response category and incorporated into the descriptive analyses. In the inferential analysis, chi-square tests were conducted considering only correct and incorrect responses; thus, "I do not know" responses were excluded in these comparisons. Statistical analyses were performed using

OpenEpi software, version 3.01[13]. A probability level of 0.05 was adopted as the threshold for statistical significance in all tests.

Ethical aspects

The research project was approved by the *Comitê de Ética em Pesquisa* of the *Universidade Estadual do Maranhão* (UEMA), under the *Certificado de Apresentação de Apreciação Ética* (CAAE) number 61306122.9.0000.5554, in accordance with Resolution No. 466/2012 of the *Conselho Nacional de Saúde* (CNS), dated December 12, 2012[14]. All participants signed the T*ermo de Consentimento Livre e Esclarecido* (TCLE) in duplicate.

RESULTS

Among the 263 study participants, there was a predominance of females, accounting for 65.5% (n = 175). In addition, the age group of 18 to 29 years was the most prevalent, comprising 23.6% (n = 62) of the individuals. A total of 34.2% (n = 90) of respondents had completed secondary education, and 70.0% (n = 184) self-identified as mixed race (pardo). With regard to household income, family arrangement, and number of rooms in the household, the predominant categories were, respectively, one to three minimum wages (n = 152; 57.8%), one to three individuals sharing the same household (n = 130; 49.4%), and five or more rooms in the same residence (n = 211; 80.0%). Regarding housing characteristics, 90.9% (n = 239) of participants reported living in brick houses with plastered walls. A statistically significant proportion of female respondents correctly identified the modes of transmission of CD (n = 82; 38.7%; $\chi^2 = 2.82$; p = 0.04), as well as the most effective measure to avoid contracting the parasitosis (n = 108; 47.3%; $\chi^2 = 6.57$; p < 0.01). For the remaining questions, no association was observed between correct responses and the participant's sex (Table 1).

Table 1. Respondents' answers regarding the causative agent and transmission routes of Chagas disease (CD) according to sex in the municipality of Lago dos Rodrigues, state of Maranhão.

Variable	Sex		Statistical analysis
	Male n (%)	Female n (%)	
Do you know which agent is responsible for causing Chagas disease?[a] (n = 173)			
Correct alternative	24 (13.8)	49 (28.3)	$\chi^2 = 0.05$
Incorrect alternative	30 (17.3)	70 (40.6)	p = 0.40
What is the name of the causative agent of Chagas disease? (n = 263)			
Correct alternative	25 (9.5)	66 (25.0)	$\chi^2 = 1.84$
Incorrect alternative	63 (23.9)	109 (41.6)	p = 0.08
Do you know how Chagas disease is transmitted?[b] (n = 213)			
Correct alternative	40 (18.7)	82 (38.7)*	$\chi^2 = 2.82$
Incorrect alternative	41 (19.2)	50 (23.4)	p = 0.04
What transmits Chagas disease?[c] (n = 239)			
Correct alternative	40 (16.7)	91 (38.2)	$\chi^2 = 1.48$
Incorrect alternative	42 (17.5)	66 (27.6)	p = 0.11
Which measure do you consider effective to avoid contracting Chagas disease?[d] (n = 229)			
Correct alternative	74 (32.3)	108 (47.3)*	$\chi^2 = 6.57$
Incorrect alternative	9 (3.9)	38 (16.5)	p < 0.01

n = number of respondents; % = percentage of respondents. [a]Responses classified as "I do not know" were excluded from the chi-square analyses = 87; [b]Responses classified as "I do not know" were excluded from the chi-square analyses = 61; [c]Responses classified as "I do not know" were excluded from the chi-square analyses = 34; [d]Responses classified as "I do not know" were excluded from the chi-square analyses = 32. χ2 = chi--square value; p = p-value. *Statistically significant number of responses.

Study participants aged 18 to 50 years provided a significantly higher number of correct answers when asked about the agent responsible for causing CD (n = 56; 32.5%; $\chi^2 = 14.85$; p < 0.0001), the transmitter of the parasitosis (n = 107; 47.3%; $\chi^2 = 32.12$; p < 0.0001), and the measure they considered effective to avoid contracting the disease (n = 126; 55.6%; $\chi^2 = 5.41$; p < 0.01). However, this same age group also showed a representative number of incorrect responses regarding the name of the causative agent of CD (n = 104; 39.7%; $\chi^2 = 10.76$; p < 0.0001) (Table 2).

Table 2. Respondents' answers regarding the causative agent and transmission routes of Chagas disease according to age group in the municipality of Lago dos Rodrigues, state of Maranhão.

Variable	Age group		Statistical analysis
	18-50 years n (%)	51-90 years n (%)	
Do you know which agent is responsible for causing Chagas disease?[a] (n = 173)			
Correct alternative	56 (32.5)*	12 (6.9)	$\chi^2 = 14.85$
Incorrect alternative	55 (31.7)	50 (28.9)	$p < 0.0001$
What is the name of the causative agent of Chagas disease? (n = 263)			
Correct alternative	65 (24.7)	17 (6.4)	$\chi^2 = 10.76$
Incorrect alternative	104 (39.7)*	77 (29.2)	$p < 0.0001$
Do you know how Chagas disease is transmitted?[b] (n = 230)			
Correct alternative	93 (40.6)	47 (20.4)	$\chi^2 = 0.11$
Incorrect alternative	57 (24.7)	33 (14.3)	$p = 0.36$
What transmits Chagas disease?[c] (n = 226)			
Correct alternative	107 (47.3)*	26 (11.5)	$\chi^2 = 32.12$
Incorrect alternative	40 (17.6)	53 (23.4)	$p < 0.0001$
Which measure do you consider effective to avoid contracting Chagas disease?[d] (n = 227)			
Correct alternative	126 (55.6)*	55 (24.2)	$\chi^2 = 5.41$
Incorrect alternative	23 (10.1)	23 (10.1)	$p < 0.01$

n = number of respondents; % = percentage of respondents. [a]Responses classified as "I do not know" were excluded from the chi-square analyses = 87; [b]Responses classified as "I do not know" were excluded from the chi-square analyses = 61; [c]Responses classified as "I do not know" were excluded from the chi-square analyses = 34; [d]Responses classified as "I do not know" were excluded from the chi-square analyses = 32. χ^2 = chi-square value; p = p-value. *Statistically significant number of responses.

Regarding educational level, individuals with no formal education or only primary education showed a statistically significant proportion of incorrect answers regarding the agent responsible for causing CD (n = 68; 35.0%; $\chi^2 = 14.71$; $p < 0.0001$), as well as its scientific name (n = 109; 41.6%; $\chi^2 = 10.76$; $p < 0.0001$). In contrast, respondents who had completed secondary education or had higher educational attainment provided statistically significant correct answers regarding how the etiological agent of CD is transmitted (n = 85; 42.1%; $\chi^2 = 15.04$; $p < 0.0001$) and the vector responsible for its transmission (n = 105; 46.8%; $\chi^2 = 80.44$; $p < 0.0001$) (Table 3).

Table 3. Respondents' answers regarding the causative agent and transmission routes of Chagas disease (CD) according to educational level in the municipality of Lago dos Rodrigues, state of Maranhão.

Variable	Educational level		Statistical analysis
	No formal education to primary education n (%)	Secondary or higher education n (%)	
Do you know which agent is responsible for causing Chagas disease?[a] (n = 195)			
Correct alternative	14 (7.1)	50 (25.6)	$\chi^2 = 14.71$
Incorrect alternative	68 (35.0)*	63 (32.3)	$p < 0.0001$
What is the name of the causative agent of Chagas disease? (n = 263)			
Correct alternative	16 (6.0)	65 (24.7)	$\chi^2 = 34.62$
Incorrect alternative	109 (41,6)*	73 (27.7)	$p < 0.0001$

Variable	Educational level		Statistical analysis
	No formal education to primary education n (%)	Secondary or higher education n (%)	
Do you know how Chagas disease is transmitted?[b] (n = 203)			
Correct alternative	43 (21.1)	85 (42.1)*	$\chi^2 = 15.04$
Incorrect alternative	47 (23.1)	28 (13.7)	$p < 0.0001$
What transmits Chagas disease?[c] (n = 225)			
Correct alternative	28 (12.4)	105 (46.8)*	$\chi^2 = 80.44$
Incorrect alternative	76 (33.7)	16 (7.1)	$p < 0.0001$
Which measure do you consider effective to avoid contracting Chagas disease?[d] (n = 225)			
Correct alternative	77 (34.2)	100 (44.6)	$\chi^2 = 1.32$
Incorrect alternative	26 (11.5)	22 (9.7)	$p = 0.12$

n = number of respondents; % = percentage of respondents. [a]Responses classified as "I do not know" were excluded from the chi-square analyses = 87; [b]Responses classified as "I do not know" were excluded from the chi-square analyses = 61; [c]Responses classified as "I do not know" were excluded from the chi-square analyses = 34; [d]Responses classified as "I do not know" were excluded from the chi-square analyses = 32. χ^2 = chi-square value; p = p-value. *Statistically significant number of responses.

Individuals who self-identified as mixed race (*pardo*) provided a statistically significant proportion of correct answers regarding the transmitter of CD (n = 100; 44.2%; $\chi^2 = 3.34$; $p = 0.03$) (Table 4).

Respondents earning at least one minimum wage showed a statistically significant proportion of correct answers when asked about the agent responsible for causing CD (n = 55; 31.3%; $\chi^2 = 14.46$; $p < 0.0001$), how it is transmitted (n = 92; 45.5%; $\chi^2 = 11.13$; $p < 0.0001$), and its transmitter (n = 93; 40.3%; $\chi^2 = 7.40$; $p < 0.01$) (Table 5).

Table 4. Respondents' answers regarding the causative agent and transmission routes of Chagas disease (CD) according to race in the municipality of Lago dos Rodrigues, state of Maranhão.

Variable	Race		Statistical analysis
	Mixed race (*pardo*) n (%)	Other n (%)	
Do you know which agent is responsible for causing Chagas disease?[a] (n = 175)			
Correct alternative	47 (26.8)	20 (11.4)	$\chi^2 = 0.31$
Incorrect alternative	70 (40.1)	38 (21.7)	$p = 0.28$
What is the name of the causative agent of Chagas disease? (n = 263)			
Correct alternative	56 (21.2)	25 (9.5)	$\chi^2 = 0.002$
Incorrect alternative	128 (48.8)	54 (20.5)	$p = 0.48$
Do you know how Chagas disease is transmitted?[b] (n = 202)			
Correct alternative	81 (40.3)	43 (21.2)	$\chi^2 = 0.17$
Incorrect alternative	54 (26.7)	24 (11.8)	$p = 0.33$
What transmits Chagas disease?[c] (n = 227)			
Correct alternative	100 (44.2)*	34 (14.9)	$\chi^2 = 3.34$
Incorrect alternative	58 (25.5)	35 (15.4)	$p = 0.03$

Variable	Race		Statistical analysis
	Mixed race (*pardo*) n (%)	Other n (%)	
Which measure do you consider effective to avoid contracting Chagas disease?[d] (n = 226)			
Correct alternative	124 (54.9)	59 (26.1)	$\chi^2 = 0.13$
Incorrect alternative	31 (13.7)	12 (5.3)	p = 0.35

n = number of respondents; % = percentage of respondents. [a]Responses classified as "I do not know" were excluded from the chi-square analyses = 87; [b]Responses classified as "I do not know" were excluded from the chi-square analyses = 61; [c]Responses classified as "I do not know" were excluded from the chi-square analyses = 34; [d]Responses classified as "I do not know" were excluded from the chi-square analyses = 32. χ^2 = chi--square value; p = p-value. *Statistically significant number of responses.

Table 5. Respondents' answers regarding the causative agent and transmission routes of Chagas disease (CD) according to household income in the municipality of Lago dos Rodrigues, state of Maranhão.

Variable	Household income		Statistical analysis
	< 1 minimum wage n (%)	≥ 1 minimum wage n (%)	
Do you know which agent is responsible for causing Chagas disease?[a] (n = 176)			
Correct alternative	16 (9.0)	55 (31.3)*	$\chi^2 = 14.46$
Incorrect alternative	55 (31.3)*	50 (28.4)	p < 0.0001
What is the name of the causative agent of Chagas disease? (n = 263)			
Correct alternative	27 (10.0)	53 (20.0)	$\chi^2 = 2.29$
Incorrect alternative	80 (31.0)	103 (39.0)	p = 0.13
Do you know how Chagas disease is transmitted?[b] (n = 202)			
Correct alternative	34 (16.8)	92 (45.5)*	$\chi^2 = 11.13$
Incorrect alternative	39 (19.3)	37 (18.3)	p < 0.0001
What transmits Chagas disease?[c] (n = 229)			
Correct alternative	40 (17.5)	92 (40.2)*	$\chi^2 = 6.98$
Incorrect alternative	46 (20.1)	51 (22.2)	p = 0.008
Which measure do you consider effective to avoid contracting Chagas disease?[d] (n = 231)			
Correct alternative	66 (28.6)	114 (49.4)	$\chi^2 = 2.54$
Incorrect alternative	25 (10.8)	26 (11.2)	p = 0.11

n = number of respondents; % = percentage of respondents. [a]Responses classified as "I do not know" were excluded from the chi-square analyses = 87; [b]Responses classified as "I do not know" were excluded from the chi-square analyses = 61; [c]Responses classified as "I do not know" were excluded from the chi-square analyses = 34; [d]Responses classified as "I do not know" were excluded from the chi-square analyses = 32. χ^2 = chi-square value; p = p-value. *Statistically significant number of responses.

DISCUSSION

The present study, with an unprecedented profile, reveals relevant aspects regarding the knowledge of part of the population of Lago dos Rodrigues, state of Maranhão, Northeast of Brazil. Overall, the findings indicate that participants demonstrated a limited and fragmented understanding of issues related to prevention, transmission, the etiological agent, and the vector of CD, highlighting important gaps in the comprehension of these elements. This limitation is significant and dependent on sex, age group, education level, race, and income, demonstrating that the limited knowledge observed in the population may represent a challenge for strengthening health education strategies and disease control actions.

The results showed significant differences in correct responses between sexes, indicating that women have a higher understanding regarding transmission routes and control measures of the parasitosis compared with men. This difference may be associated with greater female involvement in family care and more frequent contact with health services, which facilitates the circulation of information about CD. Such factors may lead to increased attention to household care practices, including cleaning routines, inspection, and the adoption of preventive measures[15]. Previous studies on the prevention of this zoonosis indicate that women tend to exhibit greater health literacy than men, reinforcing the importance of gender-sensitive approaches in educational and control programs for the disease[16,17].

Participants aged between 18 and 50 years showed difficulty in recognizing the scientific name of the etiological agent of CD. However, this limitation did not interfere with the correct identification of statements related to the type of parasite, the vector, and preventive measures for the zoonosis. These findings suggest that respondents are more familiar with terms that are accessible within the community context, which facilitates the understanding of key elements involved in the transmission dynamics of the etiological agent[18]. These results are consistent with a study conducted in Belo Horizonte, Minas Gerais, Southeast of Brazil, in which the community attributed the occurrence of the disease to the vector without establishing a direct relationship with the parasite in the transmission cycle[19]. This discrepancy between practical and technical knowledge indicates difficulties in assimilating abstract concepts within the community[18].

The findings also indicated a significant association between educational level and knowledge about CD. Participants with no formal education or only primary education showed a higher proportion of incorrect responses regarding the etiological agent and the recognition of the insect vector (triatomine bug) when compared with individuals who had completed secondary or higher education. In contrast, respondents with higher educational levels demonstrated better understanding of transmission routes and the vector responsible for transmission. Similar findings were reported in a study conducted in Zé Doca, state of Maranhão, Brazil, which identified knowledge gaps among basic education students, reinforcing the role of education in the ability to interpret health-related information[20]. Thus, higher educational attainment tends to facilitate the assimilation of disease-related concepts.

When stratified by race, participants who self-identified as mixed race (*pardo*) showed a higher rate of correct answers regarding the identification of the triatomine insect as the transmitter of the parasitosis compared with individuals of other racial groups. However, this difference did not extend to questions related to the etiological agent, transmission routes, or preventive measures, for which no statistically significant differences were observed ($p > 0.05$), indicating that race alone does not constitute a determining factor for the knowledge about the zoonosis. This scenario is particularly relevant given that 50.2% of municipalities in the state of Maranhão are considered at risk for CD. Nevertheless, this endemicity does not translate into adequate population knowledge about the disease[4]. Similar results have been described in a study conducted in Minas Gerais, where limited knowledge persists even in historically affected regions, highlighting weaknesses in educational actions developed by health services[21]. Given the wide distribution of medically important vector species in the Northeast of Brazil, such as *Triatoma brasiliensis*, *Triatoma pseudomaculata*, and *Panstrongylus megistus*[4], the implementation of educational activities tailored to the regional entomological reality is imperative[21].

The results further demonstrated a significant association between household income and knowledge about CD among respondents in the municipality of Lago dos Rodrigues. Participants with a family income equal to or greater than one minimum wage showed a higher proportion of correct responses related to the etiological agent, transmission routes, and vector identification. These findings indicate that socioeconomic factors influence health knowledge, suggesting that better economic conditions facilitate access to and appropriation of informational content about the disease. This interpretation is consistent with studies conducted in Northeast of Brazil, which identify low income as one of the main determinants of vulnerability to *T. cruzi* infection, demonstrating that social vulnerability is reflected in informational inequality[22,23].

On the other hand, no statistically significant associations were observed regarding knowledge of the scientific name of the etiological agent ($p = 0.13$) or preventive measures ($p = 0.11$). Nevertheless, from a descriptive perspective, the higher-income group showed a greater proportion of correct answers related to effective preventive measures compared with the lower-income group. This pattern suggests the persistence of technical knowledge gaps within the population, indicating weaknesses in health education strategies, since recognition of the vector is not always accompanied by an understanding of transmission mechanisms and prevention[24].

Regarding study limitations, some respondents experienced difficulties in understanding the technical terminology used in the questionnaire, which required the researchers to adapt the language to ensure the clarity and accuracy of the answers without altering the wording of the questions. In addition, resistance to participation was observed among some individuals due to concerns that the information provided could be used for inspection or enforcement purposes, even after clarification regarding the academic nature of the study and data confidentiality. Although these aspects did not compromise the execution of the study, they contributed to an extended data collection period beyond the initially established timeline.

In line with previous studies conducted in Brazil, the knowledge gaps identified in this study represent one of the factors

contributing to the high burden of CD in the country, particularly in contexts marked by social vulnerability. The chronic nature of the infection, combined with therapeutic complexity and limitations in primary prevention and early diagnosis, underscores the socioeconomic impact of the disease[25]. In this context, the results obtained in the municipality of Lago dos Rodrigues highlight the need for systematic and contextualized educational strategies capable of reducing informational disparities and contributing to the mitigation of the social determinants underlying the persistence of the disease.

CONCLUSION

The results indicate that the knowledge of the population of Lago dos Rodrigues showed statistically significant associations with social factors such as education and income, suggesting possible gaps in the current health education actions in the municipality. Based on the distribution of respondents' answers, it was observed that the majority of the population recognizes the disease vector; however, incorrect conceptions regarding the etiological agent, transmission routes, and preventive measures of this parasitosis persist. Understanding these social barriers provides important support for public policies and health programs, contributing to the mitigation of the socioeconomic impact of the disease and to the promotion of effective preventive practices among vulnerable groups within the community.

ACKNOWLEDGEMENTS

ESF acknowledges the support of the *Fundação de Amparo à Pesquisa e ao Desenvolvimento Científico e Tecnológico do Maranhão* (FAPEMA) through an Undergraduate Research Scholarship (*Bolsa de Iniciação Científica*). ANL, AMACL, and ACSJ acknowledge the support of the P*rograma Institucional de Bolsas de Extensão* (PIBEX). ACS acknowledges the support of the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (CAPES) through a master's scholarship.

REFERENCES

1. Leitão VR, Teles JR, Gonzaga YC, Araújo CM, Gomes AC, Oliveira JV, et al. Análise epidemiológica da doença de Chagas aguda no Brasil (2013–2023): padrões temporais, sazonais e por sexo em adultos de 20 a 59 anos. Braz J Implantol Health Sci. 2025; 7(11):1 789–1803. doi: https://doi.org/10.36557/2674-8169.2025v7n11p1789-1803.

2. Organização Pan-Americana da Saúde. OPAS: 70% das pessoas com Chagas não sabem que estão infectadas [Internet]. Brasília: OPAS; 2021 [cited 2025 May 13]. Available from: https://www.paho.org/pt/noticias/13-4-2021-opas-70-das-pessoas-com-chagas-nao-sabem-que-estao-infectadas.

3. Ministério da Saúde (BR). Secretaria de Vigilância em Saúde e Ambiente. Doenças tropicais negligenciadas no Brasil [Internet]. Bol Epidemiol. 2024 Jan [cited 2024 Oct 10];(Esp): 8-61. Available from: https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/boletins/epidemiologicos/especiais/2024/boletim-epidemiologico-de-doencas-tropicais-negligenciadas-numero-especial-jan-2024.

4. Ministério da Saúde (BR). Doença de Chagas Aguda: casos confirmados no Maranhão [Internet]. Brasília: DATASUS; 2025 [cited 2025 May 13]. Available from: http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sinannet/cnv/chagasma.def.

5. Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Territorialização e vulnerabilidade para doença de Chagas crônica. Bol Epidemiol. 2022 Apr [cited 2023 Jan 19]. (Esp): 1–53. Available from: https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/boletins/epidemiologicos/especiais/2022/boletim-especial-de-doenca-de-chagas-numero-especial-abril-de-2022.pdf.

6. Gomes LS, Silva FT Júnior, Matos LFL, Nunes DB, Feitosa EL, Oliveira E. Distribuição espacial e caracterização dos casos de doença de Chagas no estado do Maranhão, Brasil, 2008–2018. Res Soc Dev. 2020 Oct; 9(10): e8989109279. doi: https://doi.org/10.33448/rsd-v9i10.9279.

7. Laporta GZ, Lima MM, Costa VM, Lima MM Neto, Palmeira SL, Rodovalho SR, et al. Estimativa de prevalência de doença de Chagas crônica nos municípios brasileiros. Rev Panam Salud Publica. 2024 Apr; 48: e28. doi: https://doi.org/10.26633/RPSP.2024.28.

8. Maranhão. Governo do Estado. Governo iniciou inquérito sorológico da doença de Chagas no município de Axixá [Internet]. [cited 2025 May 13]. Available from: https://www.ma.gov.br/noticias/governo-iniciou-inquerito-sorologico-da-doenca-de-chagas-no-municipio-de-axixa.

9. Instituto Brasileiro de Geografia e Estatística. Lago dos Rodrigues: panorama [Internet]. Rio de Janeiro: IBGE; 2022 [cited 2025 May 13]. Available from: https://cidades.ibge.gov.br/brasil/ma/lago-dos-rodrigues/panorama.

10. Instituto Brasileiro de Geografia e Estatística. Lago dos Rodrigues (MA) [Internet]. Rio de Janeiro: IBGE; 2022 [cited 2026 Jan 7]. Available from: https://www.ibge.gov.br/cidades-e-estados/ma/lago-dos-rodrigues.html.

11. Instituto Brasileiro de Geografia e Estatística. Censo 2010: resultados [Internet]. Rio de Janeiro: IBGE; [cited 2026 Jan 7]. Available from: https://censo2010.ibge.gov.br/resultados.html.

12. Gordis L. Epidemiologia. Rio de Janeiro: Thieme Revinter; 2016.

13. OpenEpi. Chi-Square for 2×2 Tables [Internet]. [cited 2025 May 13]. Available from: https://www.openepi.com/Menu/OE_Menu.htm

14. Conselho Nacional de Saúde (BR). Resolução nº 466, de 12 de dezembro de 2012. Aprovar algumas diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos. Diário Oficial da União [Internet]. 2013 Jun 13 [cited 2022 Nov 4]; Seção 1: 59. Available from: https://www.gov.br/conselho-nacional-de-saude/pt-br/acesso-a-informacao/legislacao/resolucoes/2012/resolucao-no-466.pdf.

15. Silva LB, Moura MS, Madeira FP, Florencio WG, Prolo SL Júnior, Ribeiro MA, et al. Knowledge of residents about Chagas disease and its vectors in a municipality of Juruá, Amazonas. J Hum Growth Dev. 2024 Jul; 34(2): 315–27. doi: http://doi.org/10.36311/jhgd.v34.16224.

16. Triana DRR, Mertens F, Zúniga CV, Mendoza Y, Nakano EY, Monroy MC. The role of gender in Chagas disease prevention and control in Honduras. EcoHealth. 2016 Sep; 13(3): 535-548. doi: http://doi.org/10.36311/jhgd.v34.16224.

17. Romay-Barja M, Iglesias-Rus L, Boquete T, Benito A, Blasco-Hernández T. Key Chagas disease missing knowledge among at-risk population in Spain affecting diagnosis and treatment. Infect Dis Poverty. 2021 Apr; 10(1): 55. doi: https://doi.org/10.1186/s40249 021 00841 4.

18. Vivas AL, Ferreira RA, Oliveira ER, Ianes IM, Barbosa SE. Avaliação do conhecimento sobre a doença de Chagas em escolares das zonas rural e urbana de municípios endêmicos em Minas Gerais. Physis. 2022; 32(3): e320319. doi: http://dx.doi.org/10.1590/S0103-73312022320319.

19. Oliveira NW, Salles HC, Vicq FM, Ferreira RA, Mambrini JV, Diotaiuti L, et al. Conhecimentos sobre a doença de Chagas entre escolares de dois municípios de Minas Gerais, Brasil. Cad Saude Colet. 2023; 31(4): e310400121. doi: https://doi.org/10.1590/1414-462X2023310400121.

20. Mendonça AF, Jansen AC, Pinheiro IC, Almeida DT, Sá-Silva JR, Bezerra JM, et al. Knowledge of Chagas disease among students of basic education in Zé Doca, Maranhão, Brazil. Rev Patol Trop. 2025 Aug; 54(2): 1–12. doi: https://doi.org/10.5216/rpt.v54i2.81590.

21. Xavier EM, Gonçalves TS, Matos RL, Souza NN, Ferreira AM, Damasceno RF, et al. Health education activity on Chagas disease in an endemic area. RUC. 2024 Jan-Jun; 26(1): 1–9. doi: https://doi.org/10.46551/ruc.v26n1a4.

22. Dantas MH, Moura GF. Epidemiological profile of Chagas disease in North and Northeast Brazil (2018–2022). Rev Epidemiol Controle Infec. 2025 Jan–Mar; 15(3): 70–75. doi:10.17058/reci.v15i4.20308. doi: https://doi.org/10.17058/reci.v15i4.20308.

23. Silva FM, Banaggia RL, Arbusti GM, Fidelis SN, Previtalli-Silva H, Zangirolami LA, et al. Epidemiological surveillance of Chagas disease in rural communities of Piauí, Brazil. Life. 2025 Nov; 15(12): 1803. doi: https://doi.org/10.3390/life15121803.

24. Santos FL, Vasconcelos LC, Pavan TB, Sampaio DD, Jesus FS, Siqueira IC. Conhecimentos, atitudes e percepções sobre doença de Chagas em comunidades rurais da Bahia: projeto Oxente Chagas Bahia. In: Seminário Educação, Informação e Saúde: Proteções contra a Desinformação; 2025; Salvador, BA. Anais. Salvador: Softaliza; 2025 [cited 2026 Jan 7]. Available from: https://publicacoes.softaliza.com.br/semineducacaoinformacaoesaude/article/view/12966

25. Andrade MV, Noronha KV, Souza A, Julião NA, Motta-Santos AS, Braga PE, et al. Economic burden of Chagas disease in Brazil: a nationwide cost-of-illness study. Lancet Reg Health Am. 2025 Aug; 50: 101202. doi: 10.1016/j.lana.2025.101202.

How to cite this article/ Como citar este artigo:
Freire SF, Lima AN, Lima AMAC, Ávila IR, Jansen ACS, Silva AC, et al. Community knowledge about Chagas disease in a municipality in Northeast of Brazi. J Health Biol Sci. 2026; 14(1): e6334.