Tropical Medicine and International Health doi:10.1111/tmi.13516

VOLUME 26 NO 3 PP 281–289 MARCH 2021

Seroprevalence of Chagas disease in rural communities at Campinas do Piauí city, Brazil

Maricélia de Aquino Santana[1], Ana Laura da Silva Ferreira[1], Luan Victor Brandão dos Santos[1], José Henrique Furtado Campos[1,2], Layara Larice Jesuino de Sena[3] and Vagner José Mendonça[1]

1 *Departamento de Parasitologia e Microbiologia, Centro de Ciências da Saúde, Universidade Federal do Piauí, Teresina/PI, Brazil*
2 *Núcleo de Entomologia do Piauí, Universidade Federal do Piauí, Teresina, Brazil*
3 *Secretaria Municipal de Saúde, Campinas do Piauí, PI, Brazil*

Abstract

OBJECTIVES This manuscript aimed to evaluate the seroprevalence of Chagas's disease in the population of rural communities at Campinas do Piauí city, State of Piauí, Brazil.

METHODS The techniques of the indirect immunofluorescence reaction and enzyme-linked immunosorbent assay were used to detect reagent samples for Chagas disease and estimate its prevalence in the rural population. Blood samples were collected on filter paper through digital and venipuncture. Blood samples with reactive or indeterminate results were re-evaluated and subjected to the test by ELISA.

RESULTS In total, 763 blood samples were analysed from 161 residences of 18 rural communities, collected in residents aged between 2 and 92 years. In the indirect immunofluorescence reaction technique, 44 (5.8%) of the results were positive, being 40 (5.2%) confirmed by the enzyme-linked immunosorbent assay. Among the communities surveyed, we observed reactive cases in 15 of them, these cases being distributed, according to the age group, as follows: 1 case from 0 to 10 years; 13 cases from 11 to 60 years old; and 30 cases over 61 years.

CONCLUSION The results indicate that Chagas's disease remains with active transmission in the Campinas do Piaui city according to the occurrence of a case in a resident under 10 years of age. The region is endemic for Chagas's disease, as observed by the high prevalence of positive cases.

keywords trypanosomiasis, epidemiology, transmission, serology, Triatominae

Sustainable Development Goals (SDGs): 3.d

Introduction

American trypanosomiasis, also known as Chagas disease (CD), described in 1909 by Carlos Chagas, in Lassance, State of Minas Gerais, Brazil, is an illness whose aetiologic agent is the haemoflagellate *Trypanosoma cruzi* (Kinetoplastida: Trypanosomatidae). Transmission to humans occurs mainly through the faeces of insect vectors, classified in subfamily Triatominae (Hemiptera: Reduviidae), which is endemic in Latin America. Chagas disease affects 6–8 million people worldwide, with another 65 million people at risk of contracting it [1–3]. Besides vector transmission, there are also other mechanisms of acquiring infection, such as oral transmission due to consumption of food contaminated by infected faeces of triatomines, such as açaí and sugarcane juice, by transfusion transmission, congenital transmission and laboratory accidents. Oral transmission has had a great impact on the disease epidemiology, with high incidence in the Brazil northern region [4–6].

Data from the serological survey of Chagas disease in Brazil, carried out between 1975 and 1980, registered an index of 4.22% of 1352.957 analysed samples from 3026 cities of all regions of the country [7]. According to the latest records, there are estimates of approximately 1.9–4.6 million people infected by the parasite [8]. The north and north-east regions harbour most cases. In 2018, there was notification of 4685 suspected cases of Chagas disease in the acute phase, 380 (8.1%) of which were confirmed. Of these cases, 92.1% occurred in the northern region of the country, with mainly oral transmission being responsible for the increase in the number of cases in the region [8].

In the State of Piauí, the first reports on Chagas disease occurred in 1916, by Neiva and Penna, when mentioning complaints from the population of the cities of

Paranaguá, Correntes and São Raimundo Nonato, who presented clinical manifestations suggestive of megaesophagus (difficulty swallowing) and heart disease (arrhythmia) [9]. In 1975, Figueiredo *et al*. [10] reported the first autochthonous cases of Chagas disease in the state, diagnosed in patients with digestive (megaesophagus and megacolon) and cardiac manifestations, from Oeiras, Bom Jesus do Gurguéia and Castelo do Piauí cities. The data from the national serological survey registered an index of 4.04% for Chagas disease in studies carried out in 114 cities [8].

Bento *et al*., [11] in 1984–1985, identified 21.7% of seropositivity for Chagas disease among 566 people investigated in a rural population from municipalities of Castelo do Piauí and Pedro II, and a rate of 22.1% among 169 children under the age of 10 years examined in the population. In 1996, Coura *et al*., [12] in a study carried out in the urban and rural areas of the municipalities of Oeiras and Colônia do Piauí, identified a 5.9% positivity rate for Chagas disease among 4212 residents analysed and 0.5% of infection by *T. cruzi* in the population of children under 10 years of age.

A study in the State of Piauí observed a serological prevalence of 1.9% for Chagas disease, varying between 0.4% and 11.6%. The highest rates recorded in this study were in the municipalities of São João do Piauí (11.6%), Campinas do Piauí (11.5%), Capitão Gervásio de Oliveira (11.5%) and Cajazeiras do Piauí (10.8 %) in the south-eastern region of the state [13].

Chagas disease remains a serious public health problem in the State of, being endemic in large areas, mainly in the south-eastern region. The endemicity factor of Chagas disease in Piauí is directly related to the lack of surveillance, the majority of the population living in rural areas in households without plastering, which increases the probability of insect vectors and their invasion and colonisation homes of species with domiciliation capacity.

Based on epidemiological data and the lack of current studies on the prevalence of Chagas disease in the State of Piauí, this study aimed to verify the seroprevalence of Chagas disease in population of rural communities at Campinas do Piauí city, State of Piauí.

Methods

Study area

This research was conducted in a population of rural communities at Campinas do Piauí city, located in the south-eastern region of the State of Piauí, in the administrative territory named Vale do Canindé (Figure 1). It is limited by the cities of Santo Inácio and Floresta to the north, Simplício Mendes to the south and west and Isaias Coelho to the east. The municipality makes up the watershed Canindé River, with a semi-arid climate and temperatures with records of up to 41 °C during the dry season. This condition is due to the geographical location of the Piauí State between the humid Amazon forest and the dry *caatinga*, a climatic and vegetal transition zone [14]. Campinas do Piauí has a population of 5408 inhabitants (population density equivalent to 6.78 inhabitants/km^2) with 40% of the population living in the urban area and 60% in the rural area [15], the latter consisting of 101 communities, according to the Chagas Disease Control Program (PCDCh) [15].

The research was carried out in 18 rural communities representing approximately 20% of all rural areas of Campinas do Piauí city: 3 from ESF 01 (Lagoa Dantas, Lagoa Redonda and Olho D'Água dos Bois), 8 from ESF 02 (Fome, Chapadinha, Mocó, Peixe, Carnaíbas, Aroeiras, Serra and Veredas) and 7 from ESF 03 (Castelo, Vaca Brava, Volta, Retiro Velho, Joaquim Pequeno, Olho D'Água das Ovelhas and Carreiras) (Figure 2).

The locations were selected from data (Figure 2) on educational campaigns and control programmes, such as home spraying by endemic agents and community health agents more than five years ago (reference year 2019) and indicating a history of high infestation and colonisation of the vector (triatomines) or with environmental characteristics that facilitate the domiciliation of the vector insect.

For the purpose of defining the risk area, the Municipal Health Secretariat (SMS) stratifies the municipality by Area/Family Health Strategy (ESF – Estratégia de Saúde da Família) into Area 01 (ESF 01); Area 02 (ESF 02); and Area 03 (ESF 03), each of which covers a specific number of communities and is coordinated by a nurse responsible for monitoring the population health situation.

Data collection

The rural communities at Campinas do Piauí city where the research was conducted were based on the information presented by PCDCh and analysis of the municipality's epidemiological surveillance department to identify the locations with control actions registered for five years or more.

The serological survey was carried out in residents of rural communities selected at Campinas do Piauí city. During the visits to the houses, residents were invited to participate in the research after giving informed written consent, signed by legal representatives in the case of

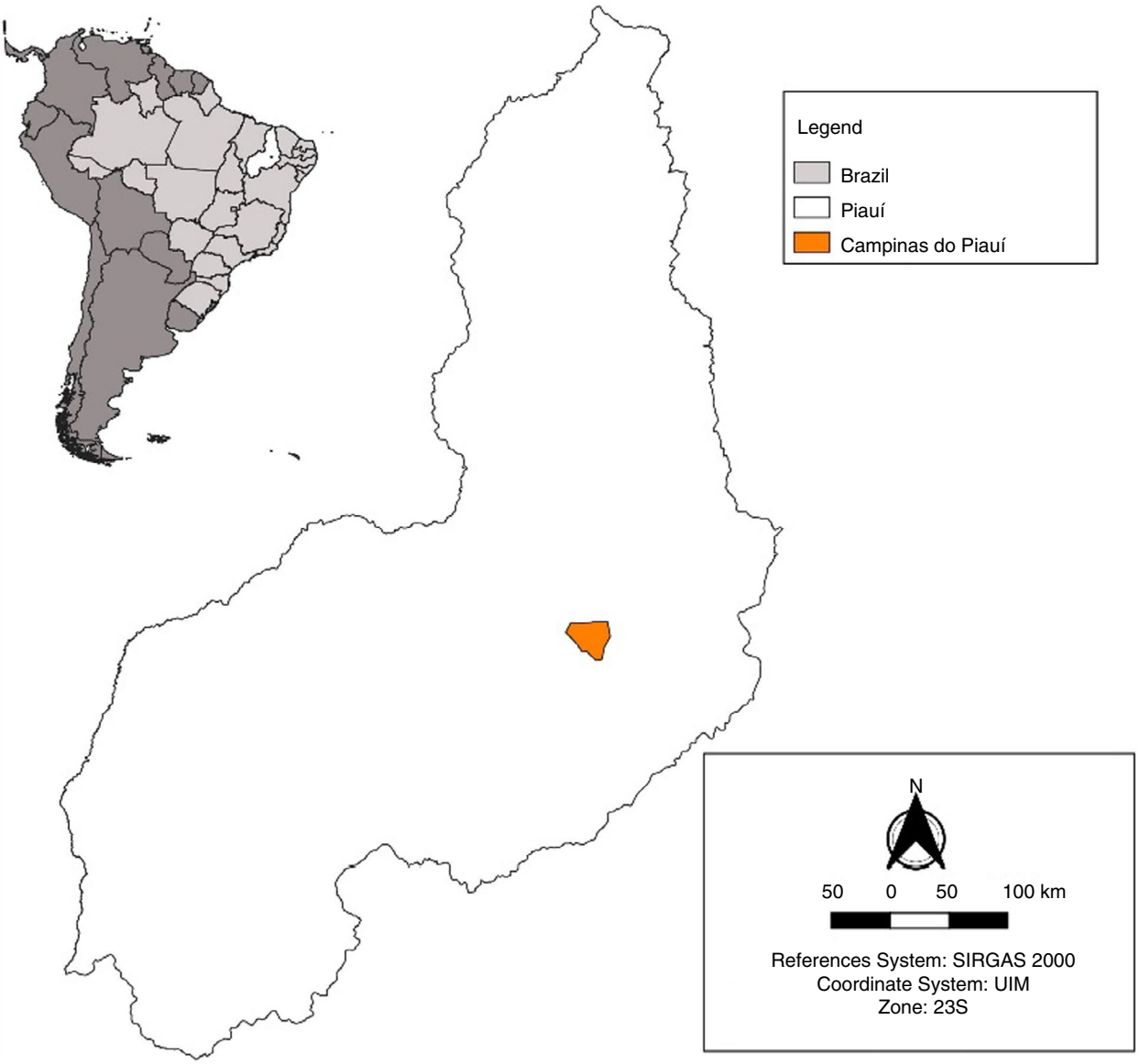

Figure 1 Map of geographic localization of Campinas do Piauí, State of Piauí, Brazil. [Colour figure can be viewed at wileyonlinelibrary.com]

minors. For blood sample collection and questionnaire application, the research conformed to ethical standards with guaranteed confidentiality, minimal benefits and risks for residents recommended by the National Research Council of the Ministry of Health of Brazil (Resolution Number 466/2012).

In total, 763 blood samples were examined of residents who agreed to participate in the research and provided a blood sample by digital puncture of the digital pulp of a finger followed by impregnation in filter paper, using a disposable lancet. The filter paper used was Klabin 80® which is impurity-free, developed for conducting surveys. Collecting samples on filter paper enables surveys with a large number of samples [13]. At the time of sampling, each filter paper was correctly identified with the participant's full name, date of birth, location and identification code. The age groups comprised ranges of 0–10, 11–60 and older than 60 years; gender, area of residence and reactivity for Chagas disease were analysed and tabulated in spreadsheets. Each filter paper was packed in an

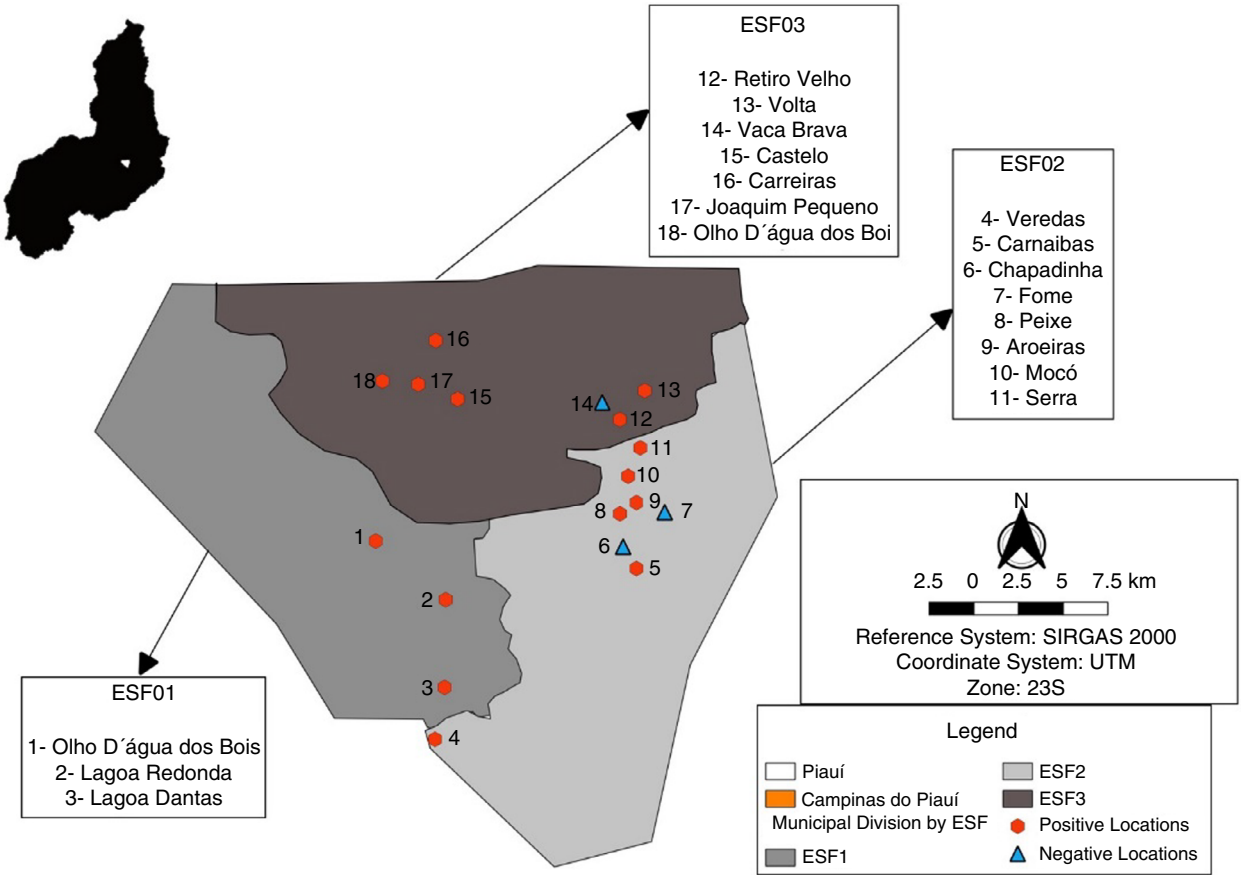

Figure 2 Geographic distribution of rural communities at Campinas do Piauí/PI, Brazil, according to Family Health Strategy team and areas where was found positive cases. [Colour figure can be viewed at wileyonlinelibrary.com]

individual plastic bag and stored in a polystyrene box, to protect the blood sample against humidity and possible variations in temperature. Samples collected at home were sent to the Parasitology Biology Research Laboratory, Labiopar, of the Parasitology and Microbiology Department of Piauí Federal University, and stored at −20 °C until processing.

All houses of the communities selected were visited. The research occurred in homes where there was a responsible person and after authorisation (for monitoring the work and signing the research responsibility term). All houses were georeferenced with GPS to map the areas. All residents were invited to participate in the research, regardless of gender and age.

Serological analysis

The laboratory diagnosis was performed by the indirect immunofluorescence reaction (IFI) technique. For the test procedure, we used the IFI Chagas Bio-Manguinhos (Fundação Oswaldo Cruz, Rio de Janeiro/RJ, Brazil) Kit, following the manufacturer's protocol, which presented sensitivity and specificity >90% for both. The work protocol determined the number of slides to be prepared considering the number of samples and their dilutions (1:40; 1:80). In total, 10 µl of the antigen was added to each slide hole, taking care to keep it homogenised during preparation. It was dried in an oven at 37° ± 1 °C for 60 min. Positive and negative control sera were diluted 1:40 in phosphate-buffered saline – PBS (for this dilution, 5 µl of the controls was used and 195 µl of PBS was added, gently homogenised to avoid the formation of bubbles). Samples were diluted (1:40 and 1:80) by adding 10 µl of the serum dilutions per orifice according to protocol. Slides were incubated in a moist chamber for 30 min at 37 ± 1 °C. Then, they were washed three times in PBS in for 5 min each time. Immediately afterwards, slides were washed quickly,

once, in distilled water and placed for 10 min at 37 ± 1°C for drying.

For reading and interpreting the reactions, an immunofluorescence microscope and 40× objective were used. The positive and negative controls were focused and observed the fluorescence present or absent in the parasites, respectively. For the test sera, the presence of uniform fluorescence in the parasite membrane was considered to be reactive from the 1:40 and 1:80 dilution; non-reactive in the absence of fluorescence in all parasites, at 1:40 and 1:80 dilutions; and undetermined the presence of fluorescence in all parasites at 1:80 dilution and absence of fluorescence at 1:40 dilution. Reagent and indeterminate samples were subjected to venous screening using the technique of enzyme-linked immunosorbent assays (ELISAs) to confirm the result performed by the indirect immunofluorescence reaction (IFI). To carry out the ELISA test, the manufacturer's protocol Chagas ELISA recombinant 3.0 – Wiener was followed, a qualitative technique for detecting *T. cruzi* antibodies, in which the sample is diluted on a support with recombinant antigens (1, 2, 13, 30, 36 and SAPA) derived from specific proteins of the trypomastigote and epimastigote forms. In studies of serological surveys, the diagnosis by ELISA, including chagasic patients, confirms 99.6% of reactive or inconclusive cases by technique IFI. All diagnostic procedures were performed in a single laboratory, ensuring homogeneous results.

For a panel of positive serology samples in the IFI method, the ELISA test has sensitivity of 99.3% and on a panel samples with negative serology for the IFI tests a specificity of 100%.

During testing precautions were observed, such as careful completion of the work protocol; distribution of positive and negative control sera in each assay in the quantities established by the kit; use of positive internal serum; repetition of the calculations to determine cut-off values, as well as the values inherent to the grey band; and registration of the work protocol number, name and lot of the kit, pipettes and equipment used, date and signature, and stapling the absorbance values with the work protocol. It was also verified that the microplate reader was adjusted to the desired length for the test and that the bottom of the plate was not wet or stained; the washer was rinsed with distilled water before use and the desired temperature was checked and recorded before the test; and at the end of the routine, the washer was disinfected and checked whether the equipment was turned off.

This kit contains a removable reagent strip polycube with cells containing immobilised recombinant *T. cruzi* antigens; human anti-immunoglobulins (goat) conjugated to peroxidase; hydrogen peroxide 60 mmol/l in 50 mmol/l citrate buffer pH 3.2 (Developer A) and tetramethylbenzidine (TMB) 0.01 mol/l in 0.1 N hydrochloric acid (Developer B); 2 N sulphuric acid (stopper); 1.4 mol/l sodium chloride in 100 mmol/l phosphate buffer and 0.1 g/l non-ionic surfactant (concentrated wash buffer); bovine albumin in physiological solution buffered with pH 7.2 phosphate buffer (sample diluent); positive control (dilution of inactivated serum containing antibodies against *T. cruzi*); and negative control (dilution of non-reactive, inactivated serum). For the processing of the tests, 10 µl of serum sample was used. The samples and reagents were brought to room temperature before the test started. The technique was started and completed without interruption. Two positive controls (CP), three negative controls (CN) and unknown ones (D) were processed. The tests were read on a spectrophotometer at 450 nm. The cut-off was obtained with negative control and positive control of the kit following the manufacturer's guidance. Samples with absorbance greater than or equal to 0.600 OD (indetermination zone: cut-off ±10%) were considered positive and samples with less than or equal to 0.150 OD were considered negative (indetermination zone: cut-off ±10%) for Chagas disease (manufacturer's instructions).

When comparing the IFI and ELISA techniques, good agreement was found between the results, as both have good sensitivity and high specificity. The IFI Chagas Bio-Manguinhos have indices of sensitivity and specificity ≥90%, and the ELISA test with positive serology has a sensitivity estimated at 99.5%. In this study, because of the small number of reagent samples in the IFI, it was possible to determine the immunodiagnosis of the infection in the ELISA. Therefore, it was proposed to standardise the IFI by assessing sensitivity and specificity by comparing the results with ELISA for the detection of IgG and IgM antibodies for the study subjects.

Once samples were confirmed as 'reagent' (positive) or 'not reagent' (negative), the results were typed, signed and forwarded to the Municipal Health Department of the municipality. Each envelope was identified and sealed containing the result and delivered to the person through community health agents in the coverage area by the city's Family Health Strategy.

Statistical analysis

The analyses were organised in a Microsoft Excel spreadsheet, and the tests were performed using SPSS Software, version 25.0. The sample calculation of the prevalence of Chagas disease was estimated considering the simple sample with an error of 5%, adding a possible loss of 10%

and a minimum size of 383 samples from the rural population. Prevalence and prevalence ratios were adjusted for IFI and ELISA and 95% confidence intervals (95% CI), and the analysis of prevalence ratios was conducted using Poisson regression with robust variance. Values were considered significant when $P < 0.05$ (significance level at 5%).

Ethical approval

The project was approved by the Human Research Ethics Committee, CAAE: 17856719.9.0000.5214, of the Universidade Federal do Piauí/UFPI, Campus Ministro Petrônio Portella, Teresina/PI, Brazil.

Results

Sampling

The survey was conducted in 256 residences, in 18 rural locations in the municipality of Campinas do Piauí. Ninety-five residences could not be surveyed because either the resident did not authorise the survey or the residence was closed at the time of the team's visit.

Serological analysis

With the exception of three communities (Chapadinha and Fome, ESF02, and Vaca Brava, ESF03), all others presented positive cases for Chagas disease infection (Table 1). The serology by indirect immunofluorescence (IFI) specific for *T. cruzi* was performed in 763 residents, representing approximately 25% of the total rural population, showed 43 (5.6%) samples as reagent (Figure 3) for Chagas disease in rural populations at Campinas do Piauí city, three of these samples were considered false positive by the ELISA method. Thus, the total number of confirmed cases was 40 (5.2%) (Table 2). The Castelo community showed the highest rate of infectivity, with 21%.

A total of 763 blood samples were examined among children, youth, adults and the elderly. The age of the participants ranged from 2 to 92 years, from both sexes and residents of the rural area. 13.5% of participants were from ESF 01, 40.6% from ESF 02 and 45.9% from ESF 03.

In the age group 0–10 years, 114 samples were analysed, of which only 1 was positive, confirmed by ELISA (CI 95% = 4.12–4.70; $P < 0.001$). It was diagnosed in a 9-year-old child, and the mother's serology was negative. In the age range of 11–60 years, 530 samples were analysed, nine of which tested positive (CI 95% = 0.41–0.84; $P < 0.001$). In those over 60 years of age, 118 samples were analysed with 30 positives. Although this prevalence was higher in this age group than in the others, this difference was not significant.

Furthermore, regarding the age group, parasitic infection was 4.41 times higher in the population aged 0–10 years (95% CI = 4.12–4.70; $P < 0.001$) when compared to 11–60 years. The prevalence was 0.41 times higher in females (95% CI = 0.06–0.43; $P < 0.001$). The positive cases for Chagas disease were 8.17 times higher in the FHS 01 (95% CI = 8.01–8.33; $P < 0.001$) in relation to the other coverage areas.

Case investigation

For confirmed cases of Chagas disease, a third visit was suggested this time by a family health team for clinical examination, referral to specialised medicine and eventual treatment of the aetiology. In the case of the child, health management, specialised referral and family support were requested for drug administration and in case of perception of possible adverse reactions to treatment.

Discussion

This research verified the epidemiological situation of Chagas disease in rural communities in the city of Campinas do Piauí, conducting serodiagnosis in approximately 25% of the residents of these areas. Altogether, 18 communities were surveyed, representing 20% of the city's rural area, with a total of 161 homes and 763 samples analysed. For the execution of the tasks and the quality of the data obtained, care was taken regarding the organisation of the planning, with the training of field teams and rigour in the execution of laboratory techniques.

Although the present survey was conducted in a single municipality in the State of Piauí, it is of great relevance in view of the number of samples collected and the seroprevalence rate found for the Chagas disease among the population from rural communities. Identifying the areas where transmission remains active, with records of acute and chronic cases, through serology, is a fundamental tool for the disease monitoring to help improve transmission control programmes.

In Piauí, the first reports of Chagas disease occurred in 1916 in the municipalities of Paranaguá, Correntes and São Raimundo Nonato, where the population manifested choking complaints (megaesophagus) and grievance (heart disease) [9]. In 1975, the first native cases occurred in the residents from Oeiras, Bom Jesus do Gurguéia and Castelo do Piauí cities [10].

Table 1 Seropositivity for Chagas disease in the rural communities surveyed according to houses with positive cases

Area	Rural communities	Surveyed houses with positive cases/Surveyed houses	Analyzed population	Positive cases (%)	Gender	
					M	F
ESF 01	Lagoa Dantas	2/18	64	2 (3.1)	0	2
	Lagoa Redonda	4/10	29	4 (13.7)	2	2
	Olho D'água dos Bois	2/5	16	2 (12.5)	0	2
ESF 02	Veredas	3/33	105	3 (2.8)	1	2
	Fome	0/11	25	0 (0)	0	0
	Serra	1/2	3	1 (3.3)	1	0
	Mocó	1/8	28	2 (7.1)	1	1
	Peixe	1/3	10	1 (1)	1	0
	Chapadinha	0/21	71	0 (0)	0	0
	Carnaiba	1/5	19	2 (10.5)	1	1
	Aroeiras	3/12	42	3 (7.1)†	2	0
ESF 03	Olho D'água das Ovelhas	2/14	45	2 (4.4)	1	1
	Vaca Brava	0/4	11	0 (0)	0	0
	Volta	8/26	78	8 (10.2)	5	3
	Retiro Velho	2/7	13	2 (15.3)	1	1
	Joaquim Pequeno	6/48	125	6 (4.8)	5	1
	Castelo	3/10	19	4 (21)	2	2
	Carreiras	2/19	60	2 (3.3)	0	2
	Total	41/256	763	44 (5.8)	23	20

†01 case not confirmed, subject not found to retake the examination.

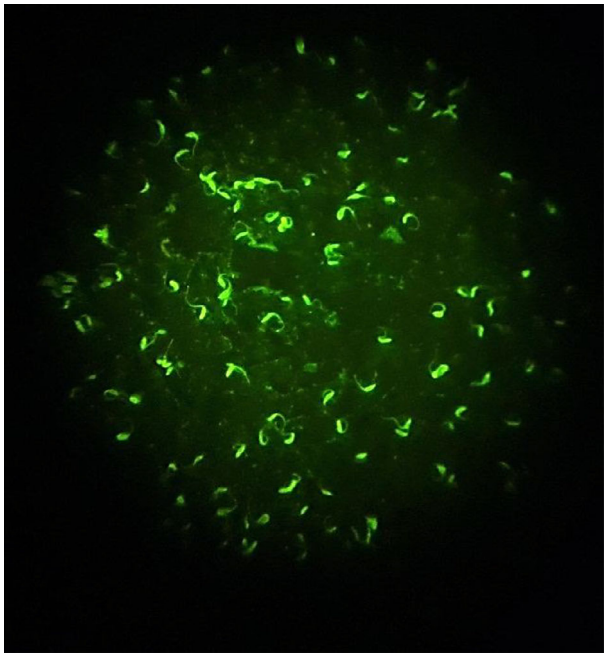

Figure 3 Positive slide of reagent sample for *T. cruzi* by Indirect Immunofluorescence Reaction (IFI) technique. [Colour figure can be viewed at wileyonlinelibrary.com]

Studies on Chagas disease seroprevalence in Piauí state began in 1976, with specific surveys carried out in the rural area of the municipalities of Oeiras and Colônia do Piauí, whose data showed 12.1% prevalence in the studied population [16]. During the period 1984–1985, in rural communities in the municipalities of Pedro II and Castelo do Piauí a prevalence of 21.7% was found [11]. In 2002, João Costa city presented a prevalence of 9.8% [17].

The results of the serological tests obtained on filter paper, with global positivity of 40 samples of the 763 collected, substantially corroborate those analysed in the serological survey carried out in the João Costa city in 2002, a time when the illness was little discussed and widely disseminated in extensive areas of state territory [17].

The global seroprevalence of human infection of Chagas disease was 4.47% in the population of 24 municipalities, located in semi-arid and caatinga areas at State of Piauí. Altogether, 6186 people with a prevalence of positivity ranging from 0.88% in the municipality of Itainopolis/PI to 11% in the municipality of Oeiras/PI were analysed among residents of the municipalities [16].

A serological survey to assess the epidemiological situation of Chagas disease in Piauí, involving all 224 municipalities [13] examined 36 399 residents, observing a

Table 2 Distribution of the examined population and confirmed cases for Chagas disease

Variable	*n* (%)	Prevalence IFI	PR (95% CI)	*P*-value	Prevalence ELISA	PR (95% CI)	*P*-value
Age group							
0–10	114 (15)	1 (0.9%)	1.04 (0.99–1.02)	0.381	1 (0.9%)	4.41 (4.12–4.70)	**<0.001**
11–60	530 (69.5)	11 (2.1%)	1.03 (0.99–1.01)	0.542	9 (1.7%)	0.21 (0.41–0.84)	**<0.001**
>60	118 (15.5)	31 (26.3%)	1	1	30 (25.4%)	1	1
Gender							
Female	418 (54.9)	20 (4.8%)	0.99 (0.99–1.00)	0.083	17 (4.1%)	0.41 (0.06–0.43)	**<0.001**
Male	344 (45.1)	23 (6.7%)	1	1	23 (6.7%)	1	1
Area							
ESF 1	103 (13.5)	7 (6.8%)	1.04 (0.99–1.01)	0.083	7 (6.8%)	8.17 (8.01–8.33)	**<0.001**
ESF 2	309 (40.6)	12 (3.9%)	1.04 (0.99–1.01)	0.085	12 (3.9%)	1.09 (1.05–1.17)	**<0.001**
ESF 3	350 (45.9)	24 (6.9)	1	1	21 (6.0%)	1	1
Serology							
Positive	40 (5.2)	40 (100%)	0.50 (0.49–0.51)	**<0.001**	40 (100%)	0.69 (0.50–0.71)	**<0.001**
Negative	722 (94.8)	3 (0.4%)	1		0 (0.0%)	1	1

CI, confidence interval; ELISAs, enzyme-linked immunosorbent assays; IFI, indirect immunofluorescence reaction; PR, prevalence ratio. Values in bold represent differences between species are significant (analysis of variance—$p < 0.001$).

prevalence of 1.9%. In Campinas do Piauí city, 174 samples were analysed, observing a positivity index of 11.5%. In the present study, 763 samples were analysed, representing approximately 15% of the all municipality's population, with an infectivity rate of 5.2%. According to reports by the Municipal Health Department of the municipality, the decrease in cases may be related to housing improvement programmes carried out in the rural area at the beginning of the decade, which significantly reduced the number of vectors inside the homes.

In Brazil, Fernandes *et al*. [18] outlined Chagas disease incidence and prevalence panorama between the years 2000 and 2013 through a systematic review study and meta-analysis to estimate the data and concluded that the prevalence fluctuated between the years 1980 and 2012, varying between 4.4% in the 80s and 2.4% after the 2000s, with emphasis on the prevalence of Chagas disease cases among women over 60 years of age residing in the north-east and south-east regions of the country in mixed areas (rural and urban zones). Between 2003 and 2018, there was an inversion in the occurrence of the illness as of 2007, concentrating the largest number of cases of acute Chagas disease in the north region of the country with probable change in the way of the transmission (oral), but there is also a continuity of positive cases transmitted by vector in the Brazil north-east region [8].

The risk of vectorial transmission of Chagas disease persists, and studies in this line of research, although scarce, have sought to deepen the assessment of the different control strategies in vector transmission, but the other transmission ways (congenital, transfusion and oral) are not dismissed. These data are observed in the evaluations of several authors and collaborators in relation to the Chagas disease panorama and its prevalence among residents living in rural areas in different Brazilian states, with the evaluation of some reports mentioned in this study [19]. The rate in children under 10 years old was 0.8% close to the Borges-Pereira findings in the João Costa city, with 0.5% positivity [17]. In the 2001-2008 national serological survey, 0.01% (11) of the population of children living in the rural area was positive for Chagas disease [20]. In Campinas do Piaui city, the finding (0.8%) for children under 10 years of age and sons of a mothers not infected with the disease excludes the possibility of congenital transmission [21].

The control of intra-household vector transmission determines the prevalence of infection in this specific population (children) and highlights irregularities in measures to combat and control the transmission of Chagas disease in the municipality.

Conclusions

Campinas do Piaui is endemic for Chagas disease, with high prevalence. The possibility of active vector transmission cannot be excluded due to identifying a case under 10 years of age with non-reactive parents. Measures that encourage entomological surveys in the area, education programmes, installation of Triatomine Information Stations (PIT) and training of health workers are essential in combating and reducing the transmission of Chagas disease in the endemic areas.

Acknowledgements

We would like to thank the Health Department of the Campinas do Piaui city for making available community health agents and agents to combat endemic diseases, and the Central Laboratory of Piauí for the supply of materials used in data collection.

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Corresponding Author **Vagner José Mendonça**, Departamento de Parasitologia e Microbiologia, Centro de Ciências da Saúde, Universidade Federal do Piauí Campus Ministro Petrônio Portella, Teresina/PI, Code Postal 64049-550, Brazil. Tel: +55 86 3215 5865; E-mail: vagnerjose@ufpi.edu.br