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Brief communication

Seroprevalence of human cysticercosis in Jataí, Goiás state, Brazil

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ABSTRACT

The *Taenia solium* cysticercosis affects millions of people worldwide and is considered a public health problem, especially in developing countries. The diagnosis of neurocysticercosis (NCC) is complex and involves the analysis of epidemiological, clinical, neuroimaging, and immunological host data. NCC is endemic in Brazil, and is related to the cause of death mainly in the Southeast, South, and Central-West regions. The objective of this study was to determine the seroprevalence of cysticercosis in inhabitants of the city of Jataí, Goiás, in the Central-West region of Brazil from April to August 2012. A total of 529 serum samples were analyzed by enzyme-linked immunosorbent assay (ELISA) for detecting IgG antibodies against *T. solium* larvae, and Western blotting (WB) was used for confirming the diagnosis through the recognition of at least two specific peptides from their serum antibodies. The 351/529 (66.3%) reactive samples were analyzed by ELISA and WB confirmed the diagnosis in 73 samples that recognized at least two of the following peptides specific IgG antibodies for cysticercosis: 18, 24, 28–32, 39–42, 47–52, 64–68, and 70 kDa. The seroprevalence of cysticercosis was 13.8% (95% CI 5.9–21.7), demonstrating that the studied area is endemic to this disease.

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The *Taenia solium* cysticercosis affects millions of people worldwide and is considered a public health problem, especially in developing countries.¹ The *T. solium* life cycle involves both human and pig hosts. Cysticercosis occurs after ingestion of eggs of *T. solium* by fecal contamination of human host. Larval infection can be diagnosed in different tissues, such as skeletal muscle, subcutaneous and central

nervous system tissue.² Human neurocysticercosis (NCC) is the most severe form, because about five million cases of epilepsy worldwide are related to this parasitosis.² NCC is a neglected tropical disease recognized by the World Health Organization since 2010; it is endemic in several countries in Latin America, sub-Saharan Africa and Asia, including India, most of Southeast Asia, and China.³ Agapejev⁴ conducted a critical analysis of Brazilian literature (1915–2002) which showed an NCC frequency of 1.5% in autopsies and 3.0% in clinical studies. In seroepidemiological studies the positivity

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of specific reactions was 2.3%. In Brazil, between 2000 and 2011, a total of 1829 deaths related to NCC were recorded, which represented 0.015% of all deaths. High-risk clusters of NCC-related mortality were evidenced in endemic areas in the Southeast, South and Central-West regions.⁵ The North and Northeast regions usually have no specific control programs; people from these areas have limited access to health services, and the living conditions are poor.^{4,5}

This zoonosis is directly related to risk factors such as disordered urbanization, precarious conditions of basic and hygienic sanitation, close contact with pigs, and poor health surveillance present in the regions where the human infection is endemic, as well as cultural behavior and internal migration of people from rural areas to urban centers.^{5,6} Swine cysticercosis is not well recorded in Brazil due to clandestine slaughter of pigs, along with limited inspection and sanitary control.⁷ Notification of diagnosed cases of NCC is not considered compulsory in Brazil, although it is recommended by the Ministry of Health. Only the South and Southeast regions of the country use this strategy to investigate infection cases for prevention programs with increased coverage and access to diagnosis through neuroimaging tests, along with clinical and surgical treatment.⁴ Prevention and control of *T. solium* transmission should be a priority as intervention can reduce the substantial healthcare and economic burdens due to both NCC and taeniasis.⁸

The objective of this study was to determine the seroprevalence of human cysticercosis in serum samples from inhabitants of the municipality of Jataí, Goiás state, in the Central-West region of Brazil.

The study was carried in the municipality of Jataí (17° 52' 53" S, 51° 42' 52" W), 330 km from the capital of Goiânia, located in the southwest of the state of Goiás, Brazil. The municipality area of 7174 km² has an estimated population of 97,077 inhabitants.⁹ This study was approved by the Research Ethics Committee of the Federal University of Goiás (UFG), under protocol number 230/2011.

A total of 529 individuals (301 females and 228 males) participated in the study. All individuals older than 18 and representatives in the case of children (≥ 4 years old), who agreed to participate in the study, signed the informed consent. They were selected voluntarily from the waiting rooms of three clinical analysis laboratories (two private and one public) in the city under study. The participants consented to donate 2 mL of serum remaining after the serological and/or biochemical tests that were requested by the doctors who took care of them. The serum samples were donated from April to August 2012, transported under refrigeration and stored at -20°C at the Immunology Laboratory of UFG Regional Jataí.

A total saline extract with 50 metacestodes of *T. solium* was prepared and the obtained extract was divided into aliquots of 200 μL , identified and stored at -20°C until processing. Serum samples were submitted to the ELISA test in accordance with Barcelos et al.¹⁰ Some 200 μg of the total saline extract protein was applied by 10×8 cm gel and subjected to 12% polyacrylamide gel electrophoresis (SDS-PAGE) for separation of the peptides present in the antigenic extract and subsequent transfer to 0.45 μm pore size nitrocellulose membranes. After transfer, the nitrocellulose membranes were cut into 3 mm strips. The antigenic peptides recognized by IgG antibodies

Table 1 – Frequency of peptide recognition by Western blotting test through IgG antibodies against the total saline extract of *Taenia solium* metacestodes in 314 serum samples from inhabitants of the municipality of Jataí, Goiás, from April to August 2012.

Type and number of peptides recognized	Number of reagent samples	Recognition frequency (%)
Only non-specific	85	27.1
One specific	156	49.7
Two specific	62	19.7
Three specific	5	1.6
Four specific	6	1.9
Total	314	100.0

Table 2 – Distribution of the 73 individual reagents in the ELISA and Western blotting tests in relation to age group and sex.

Age group (years) ^a	Sex	
	Female	Male
11–20	5	4
21–30	4	6
31–40	7	6
41–50	13 ^a	9
51–60	6	2
61–70	3	3
71–80	0	2
81–90	0	3
Total	38	35

^a $p = 0.0182$ by two-way ANOVA.

present in the reagent serum samples in the ELISA were analyzed by Western blotting (WB).¹⁰ The criterion for positivity in WB adopted was the recognition of at least two of the peptides, 18, 24, 28–32, 39–42, 47–52, 64–68, and 70 kDa, in WB specific for cysticercosis.¹⁰ The results obtained in the ELISA and WB were analyzed using two-way ANOVA and Fisher's exact tests with $p \leq 0.05$ in the software GraphPad Prism version 5.0. The total saline extract of *T. solium* metacestodes was prepared for use in both tests and presented a protein concentration of 3000 $\mu\text{g}/\text{mL}$.

All 529 serum samples were analyzed by ELISA to detect IgG antibodies against cysticercosis and 351 (66.3%) samples were reactive. All reagent serum samples analyzed by ELISA were submitted to WB, resulting in 37 samples (10.5%) with no peptide recognition and 314 (89.5%) were reagents. Seventy-three of the 314 samples with two or more peptides were considered reagent according to the diagnostic criterion adopted in WB for cysticercosis¹⁰ (Table 1). Therefore, 13.8% (95% CI 5.9–21.7) of the 529 serum samples analyzed showed *T. solium* anti-metacestode antibodies in ELISA and recognition of specific peptides for NCC in WB. Of the 73 participants that showed specific band recognition in WB, 38 (52%) were female and 35 (48%) male. Positivity among females aged 41–50 years was significantly higher ($p = 0.0182$) (Table 2). The specific peptides that were significantly more often recognized by

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