

Frequency of *Toxoplasma gondii* antibodies in bovines in the state of Pernambuco, Brazil

Frequência de anticorpos anti-*Toxoplasma gondii* em bovinos do estado de Pernambuco, Brasil

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Abstract

Toxoplasmosis is a parasitic disease caused by *Toxoplasma gondii* that affects homeothermic animals, including humans. Felines are considered the definitive host of this parasite, while other animals act as intermediate hosts. The purpose of this study was to assess the frequency of anti-*T. gondii* IgG antibodies in bovines in the state of Pernambuco, Brazil. Serum samples (n = 427) from animals in 13 municipalities of the coastal forest/plantation region of the state were analyzed using the immunofluorescent antibody test (IFAT). The overall results revealed a prevalence rate of 16.63% (27/427). High percentages of positivity were found among animals aged 25 to 36 months (28.57%; 30/42) and in males (22.22%; 2/9). The present findings suggest that bovine toxoplasmosis is endemic in the area under study.

Keywords: toxoplasmosis, parasitic disease, infection, zoonosis, diagnosis, immunofluorescent antibody test.

Resumo

Toxoplasmose é uma doença parasitária que infecta todos os animais homeotérmicos, incluindo o homem. Na epidemiologia da infecção, os felinos são os hospedeiros definitivos, e outros animais são os hospedeiros intermediários do *Toxoplasma gondii*. O objetivo deste trabalho foi determinar a frequência de anticorpos IgG anti-*Toxoplasma gondii* em bovinos do Estado de Pernambuco. Para tanto, foram coletadas 427 amostras de soro sanguíneo de bovinos provenientes de 13 municípios localizados na Zona da Mata do Estado de Pernambuco. Tais amostras foram analisadas pela técnica de Imunofluorescência Indireta para pesquisa de anticorpos anti-*Toxoplasma gondii*. A frequência observada foi de 16,63% (27/427). Anticorpos anti-*Toxoplasma gondii* foram mais frequentes (28,57%) em animais com idade entre 25-36 meses de idade. Considerando-se por sexo, observou-se uma maior positividade entre os machos que apresentaram 22,22% (2/9). Os resultados demonstram que a toxoplasmose é endêmica nessa região.

Palavras-chave: toxoplasmose, doença parasitária, infecção, zoonose, diagnóstico, imunofluorescência indireta.

Introduction

Toxoplasmosis is a parasitic disease caused by the protozoan *Toxoplasma gondii*, which has a cosmopolitan distribution and can infect different species of animals, including humans (TENTER et al., 2000). Wild and domestic felines are considered the definitive hosts. Enteroepithelial multiplication of the protozoan occurs in these species, resulting in the production of oocysts and elimination through the feces (DUBEY et al., 1977).

Among livestock, infection by *T. gondii* has been reported in several species, with goats, sheep and pigs showing greater susceptibility than cattle and horses (MILLAR et al., 2008). Infection can have a negative effect on reproduction in these animals, which may lead to economic losses. In bovines, *T. gondii* cysts have been found in the retina and diaphragm, indicating the participation of this species in the transmission of the parasite (AMATO NETO et al., 1995).

Considering the importance of toxoplasmosis to both public and animal health, the purpose of this study was to determine the seroprevalence of anti-*T. gondii* IgG antibodies in bovines in different municipalities in the coastal forest/plantation region of the state of Pernambuco, Brazil.

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Materials and Methods

Study area

The coastal forest/plantation region (34°80'E 30°20'W) comprises 43 municipalities and covers an area of 8738 km² in the state of Pernambuco, corresponding to 8.9% of the state's total territory. Animals from 13 municipalities of this region were analyzed in the present study.

Samples

Serum samples (n = 427) were kindly provided by the National Livestock Laboratory of Pernambuco. The samples came from crossbred animals in different municipalities in the coastal forest/plantation region of the state and were analyzed using the immunofluorescent antibody test (IFAT), following the method described by Camargo (1964). A titer of 1:64 was used as cutoff (DAGUER et al., 2004).

Statistical analysis

The data were analyzed using the chi-square test or Fisher's exact test with the aid of the BioEstat program (version 5.0; Mamirauá/CNPq, Belém, PA, Brazil) (AYRES et al., 2007).

Results and Discussion

Among the 427 samples tested, 16.63% (71/427) scored positive for anti-*T. gondii* IgG antibodies. This prevalence rate is higher than rates previously reported in the states of Bahia, São Paulo, Minas Gerais and Mato Grosso do Sul, which ranged from 3.2 to 12% (ARAÚJO et al., 1998; GONDIM et al., 1999), but lower than rates reported by Marana et al. (1994), Marana et al. (1995), Costa (2001), Daguer et al. (2004) and Ogawa et al. (2005), who detected anti-*T. gondii* antibodies in cattle in the states of Amazonas, São Paulo, Paraná and Rio Grande do Sul (prevalence rate: 25.8 to 49.9%). The present results (Table 1) are similar to those reported by Albuquerque et al. (2005) for the state of Rio de Janeiro, who detected 14.77% positivity (87/589) among the animals using the IFAT.

In a previous study carried out in the *Agreste* (a region of transition between the coastal and semi-arid regions of the interior of the state) and the coastal forest/plantation region of Pernambuco, Silva et al. (2003) detected 51.96% positivity using IFAT, with a higher prevalence rate found in the coastal forest/plantation region. The climatic conditions of this region favor the maintenance of viable oocysts in the environment, which are an important source of transmission to herbivores (SILVA et al., 2003).

From the public health standpoint, the epidemiology of toxoplasmosis in bovines is very important. Cattle can be infected through the ingestion of pasture containing *T. gondii* oocysts, which is frequently observed in extensive farming systems (MARANA et al., 1994). Moreover, congenital transmission occurs when females acquire the infection and transmit it to the fetus (MILLAR et al., 2008). However, it should be stressed that although bovines

may be infected, they rarely develop clinical signs of the disease (DUBEY; THULLIEZ, 1993).

Despite the fact that bovines seem to be more resistant to infection than other animals (DUBEY, 1994), the parasites may remain viable in their tissues until slaughtering age (DUBEY, 1983), as cysts have been found in the retina and diaphragm of cattle (AMATO NETO et al., 1995). In this context, people who handle beef without proper hygiene may play an important role in maintaining *T. gondii* (DAGUER et al., 2004).

In Brazil, there has been an increase in the consumption of raw or undercooked beef, especially in areas with no federal inspection service. It has been demonstrated that *T. gondii* cysts remain viable for 4 minutes when subjected to 60 °C and up to 10 minutes when subjected to 50 °C. These data demonstrate that some cysts may survive the cooking process, especially when cooking does not occur evenly, as in microwave ovens (LUNDÉN; UGGLA, 1992). Similarly, cysts can remain infective in carcasses refrigerated from 1 to 4 °C for more than three weeks and carcasses kept at -8 to -1 °C for more than one week (KOTULA et al., 1991).

Contaminated milk and dairy products containing viable tachyzoites constitute another important source of infection for humans (HIRAMOTO et al., 2001). It is possible that some risk factors, such as the feline population, exposure to domestic cats and water contamination, may have contributed to the number of positive animals reported herein (ALBUQUERQUE et al., 2011).

When analyzing the data according to age (Table 2), higher positivity was found among animals aged 25 to 36 months of age,

Table 1. Absolute (AF) and relative frequency (RF) of anti-*T.gondii* IgG antibodies in bovines from the coastal forest/plantation region of Pernambuco.

Municipality	Positive		Negative	
	AF	RF (%)	AF	RF (%)
Água Preta	6	24.00	19	76.00%
Amaraji	2	13.33	13	86.67
Barreiros	0	0	16	100
Chã de Alegria	5	45.45	6	54.55
Escada	0	0	12	100
Glória do Goitá	6	12.77	41	87.23
Macaparana	0	0	52	100
Maraial	10	40.00	15	60.00
Palmares	2	11.11	16	88.89
Pombos	9	13.24	59	86.76
Quipapá	3	15.00	17	85.00
São Lourenço da Mata	10	40.00%	15	60.00
Vitória de Santo Antão	18	19.35	75	80.65
Total	71	16.63	356	83.37

Table 2. Absolute (AF) and relative frequency (RF) of anti-*T. gondii* IgG antibodies in bovines from the coastal forest/plantation region of Pernambuco, as a function of age.

Age (months)	Positive		Negative	
	AF	RF (%)	AF	RF (%)
0-24	3/18	16.67	15/18	83.33
25-36	12/42	28.57	30/42	71.43
≥36	56/367	15.26	311/367	84.74
Total	71/427	16.63	356/427	82.67

Table 3. Absolute (AF) and relative frequency (RF) of anti-*T. gondii* IgG antibodies in bovines from the coastal forest/plantation region of Pernambuco, as a function of sex.

Gender	Positive		Negative	
	Positive/Total	%	Positive/Total	%
Female	69/418	16.51	349/418	83.49
Male	2/9	22.22	7/9	77.78
Total	71/427	16.63	418/427	83.37

but this association was not statistically significant ($p = 0.089$). This finding is in agreement with data reported by Arias et al. (1994), but differs from data reported by Moura et al. (2010), who detected a higher rate of infection in adults.

Regarding the sex of the animals (Table 3), males exhibited a higher rate of positivity (22.22%). However, the difference between the population size of males and females may have interfered with this result, as previously observed by Moura et al. (2010). Moreover, this association was not statistically significant (Fisher's exact test; $p = 0.648$).

All the animal samples from the municipalities of Escada, Barreiros and Macaparana scored negative, suggesting that, at that time, the herd was free from *T. gondii* infection.

The frequency of animals testing positive indicates that the coastal forest/plantation region in the state of Pernambuco, Brazil, is an endemic area for *T. gondii* in bovines.

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