Research Note

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Seroprevalence and risk factors for *Toxoplasma gondii* infection in pigs in southern Piauí

Soroprevalência e fatores de risco para infecção por *Toxoplasma gondii* em suínos no Sul do Piauí

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Abstract

This study is aimed to assess the prevalence and risk factors associated with *T. gondii* infection in pigs. We evaluated 143 pigs, in 10 randomly-chosen farms located in Southern Piauí. The pig's blood serum was analyzed through ELISA in detection of anti-*T. gondii* antibodies. A seroprevalence of 25.5% was observed in the pigs that reacted against *T. gondii* antigens. The data from the records demonstrated an association with some factors such as: age, diet, type of management, breed and presence of cats in the farms with a prevalence of *T. gondii*. With the exception of sex, all others features represent risk factors for *T. gondii* infection. Furthermore, our data contributed to the understanding of the *T. gondii* seroprevalence in pig farms located in Southern Piauí.

Keywords: Toxoplasmosis, pig, seroprevalence, Piauí.

Resumo

Este estudo teve como objetivo avaliar a soroprevalência e os fatores de risco associados a infecção por *T. gondii* em suínos. Foram avaliados 143 suínos em 10 propriedades localizadas no Sul do Estado do Piauí. Os soros dos suínos foram analisados para a detecção de anticorpos anti-*T. gondii* pela técnica de ELISA. Encontrou-se uma soroprevalência de 25,5% em suínos reativos para antígenos de *T. gondii*. Por meio de fichas, alguns fatores como idade, dieta, raça, sistema de criação e presença de gatos foram associados à presença de *T. gondii*. Com exceção do sexo, todas as outras características representaram fatores de risco para a infecção com o parasita. Os dados contribuem para a compreensão da soroprevalência de *T. gondii* de suínos criados no Sul do Estado do Piauí.

Palavras-chave: Toxoplasmose, suínos, soroprevalência, Piauí.

T. gondii is the toxoplasmosis agent, a disease that is usually benign in immunocompetent individuals; however it can be severe or fatal in children with congenital diseases or in immunosupressed patients (DUBEY et al., 2012). In farmed animals, such as sheep, pigs and goats, infection by *T. gondii* is common and can lead to great economic loss through stillbirths, miscarriages and birth defects (UZÊDA et al., 2004). Food-borne transmission of *T. gondii* is considered to be the most important route for human infection (PEREIRA et al., 2010; DAVIES, 2011), which occurs through the ingestion of tissue cysts while handling or eating raw or undercooked meat. Free-range meat production is a trend that may increase the risk of parasite-infection. Most importantly, the consumption of raw or undercooked meat from *T. gondii* infected pigs represents the major risk for *T. gondii* infection in humans (DUBEY, 2009; DUBEY et al., 2012). According to the Associação Brasileira de Indústria Produtora e Exportação de Carne Suína – ABIPECS (2011), Brazil exported over 582 thousand tons, of swine meat, in 2011. The State of Piauí holds 17% of the swine herd in the northeast region and represents the third largest herd in northeastern Brazil (IBGE, 2006). Despite the importance of pork supply in Brazil, no study of *T. gondii* prevalence has been carried out in this region. Hence, this study is the first one to correlate *T. gondii* seroprevalence and possible risk factors for *T. gondii* infection and transmission among swine herds in the southern region of the State of Piauí.

In order to conduct this study, one hundred and forty-three samples were randomly collected from 10 swine farms located in

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six of the eleven cities of the Alto-Médio Gurguéia region, in the south of Piauí (Table 1), throughout the months of November and December 2010. This study was approved by the Comitê de Ética em Experimentação com Animais – CEEA/UFPI (nº. 060/2010). At the time the samples were collected, some of the animal's characteristics were registered in individual sheets, including location, number and age, conditions of confinement (intensive or semi-intensive production), food and water offered and presence or not of cats in the farms (Table 2). Blood samples were collected and the seraum obtained was used to detect IgG antibodies against *T. gondii* by ELISA, as described by Silva et al., (1997). The samples' results were seropositive when ELISA Index (EI) > 1.2. Statistical analysis was performed using the GraphPad Prism 4.0 software (Graphpad Sofware Inc., San Diego, USA). Seropositivity percentages were compared through the Chi-square (χ^2) test or Fisher exact test, when appropriate. Values of $P < 0.05$ were considered statistically significant.

According to the results, 25.5% (37) of the samples collected presented antibodies to *T. gondii*. Despite the high prevalence, our results are similar to those found in pigs in other Brazilian States: 17,22% in Santa Catarina (PERDONCINI et al., 2010); 25.5% in Paraná (MILLAR et al., 2008) and 50% in Belém (FREITAS et al., 2009). Animals tested positive for *T. gondii* were detected in all the analyzed cities. Among all the regions Cristino Castro, presented the highest number of seropositives pigs, followed by the cities of Bom Jesus and Currais (Table 1). Considering all the studied

Table 1. Distribution of seropositive or seronegative pig samples for *T. gondii*. Analysis of the cities located in the Alto Medio Gurguéia region, during the months of November and December, 2010.

City	Nº of collect serum	ELISA	
		Reagent (%)	No Reagent (%)
Bom Jesus	48	16 (33)	32 (67)
Santa Luz	30	4 (13)	26 (87)
Palmeira	10	1 (10)	9 (90)
Cristino Castro	10	5 (50)	5 (50)
Currais	28	9 (32)	19 (68)
Redenção do Gurgueia	17	2 (12)	15 (88)
Total	143	37 (25.8)	106 (74.2)

Nº - number; % - percentage.

Table 2. Description of environmental and farm management and pig characteristics and co-related with anti-*Toxoplasma gondii* antibodies in pigs from Southern Piauí.

Variant		*ELISA*		*Test serum*	*Statistic*
		Reagent	*No Reagent*		
Sex	Male	15 (22.7%)	51 (77.2%)	66 (46.15%)	$\chi^2 = 0.6329$ $p = 0.4263$
	Female	22 (28.5%)	55 (71.5%)	77 (53.85%)	
	Total	37 (25.9%)	106 (74.1%)	143	
Pig's age	Piglet	6 (10.15%)	51 (89.85%)	57 (39.8%)	**$\chi^2 = 10.12$ $p = 0.00015$**
	Growth	24 (34.8%)	45 (65.2%)	69 (48.2%)	
	Finishing	7 (41.2%)	10 (58.8%)	17 (12%)	
	Total	37 (25.9%)	106 (74.1%)	143	
Diet	Ration	6 (16.6%)	30 (83.4%)	36 (25.2%)	**$\chi^2 = 41.05$ $p < 0.0001$**
	Human food	13 (100%)	0(0%)	13 (9.1%)	
	Both	18 (17.6%)	76 (82.4%)	94 (65.7%)	
	Total	37 (25.9%)	106 (74.1%)	143	
System	Intensive	20 (18.5%)	88 (81.5%)	108 (75.5%)	**$\chi^2 = 12.45$ $p = 0.0004$**
	Semi-intensive	17 (48.5%)	18 (51.4%)	35 (24.5%)	
	Total	37 (25.9%)	106 (74.1%)	143	
Management Type	Family	22 (24.7%)	67 (75.2%)	89 (62.2%)	$\chi^2 = 0.7417$ $p = 0.6902$
	Company	6 (23%)	20 (77%)	26 (18.2%)	
	Both	9 (32.15%)	19 (67.85%)	28 (19.6%)	
	Total	37 (25.9%)	106 (74.1%)	143	
Breed	Pure	13 (21.0%)	49 (79.0%)	62 (43.3%)	**$\chi^2 = 41.36$ $p < 0.0001$**
	Cross	11 (16.2%)	57 (83.8%)	68 (47.6%)	
	Not defined	13 (100%)	0 (0%)	13 (9.1%)	
	Total	37 (25.9%)	106 (74.1%)	143	
Presence of cats	Yes	35 (29.9%)	82 (70%)	117 (81.8%)	**$\chi^2 = 15.74$ $p < 0.0001$**
	No	2 (7.7%)	24 (92.3%)	26 (18.2%)	
	Total	37 (25.9%)	106 (74.1%)	143	

characteristics, only variables such as sex and reason for rearing (animals designated to subsistence agriculture or to industrial manipulation) were not considered as risk factors for infection by *T. gondii* (Table 2). A recent review reported that the association between sex and *T. gondii* seroconvertion is a bias linked to the high number of females in the studies collected (DA SILVA et al., 2010). We obtained a balanced number of females and males (ratio of 1.47) and, therefore, the data from this study in southern Piauí refutes the relationship between sex and *T. gondii* infection in pigs, and supports the data collected by Frazão-Teixeira and Oliveira (2011). Another recognized risk factor for infection by *T. gondii* in livestock is the pig's age (DA SILVA et al., 2008). Our data also demonstrated that exposure to parasites increased with the animal's age (χ^2 = 10.12, p = 0.00015). The final pig's phase was found to be the most susceptible to *T. gondii* (41%) (Table 2). Additionally, the pigs in the culling state presented a higher level of *T. gondii* antibodies compared to the piglets. According to Da Silva et al. (2010), the pig's age is closely associated to the risk of infection in humans, as the older pig's carcasses are generally used in the preparation of swine products. The type of food supply-used also offers risks of contamination. Pigs fed with human food scraps presented more antibodies to *T. gondii* (100%), compared to pigs that received ration (16.6%) and those fed on both diets (χ^2 = 41.05, p < 0.0001) (Table 2). These particular results showed the precarious situation of swine farming in southern Piauí, where herds are still fed with human food scraps, probably, favoring the life cycle of *T. gondii*. Accordingly, our results indicate that the swine reared in an intensive system were less exposed to *T. gondii* (18.5%) than those maintained in a semi-intensive system (48.5%) (χ^2 = 12.45, p < 0.0004) (Table 2). The risk of the semi-intensive method is associated with the animal's access to soil or water contaminated with parasite oocysts (SUARÉZ-ARANDA et al., 2000). The pig's exposure to both risk factors: semi-intensive system and human food feeding, probably justified the high exposure of *T. gondii* among the non defined breed pig (χ^2 = 41.36, p < 0.0001). Another important risk factor for *T. gondii* infection was the presence of cats in the farms (29.9%) (χ^2 = 15.74, p< 0.0001) (Table 2). The presence of cats increases *T. gondii* seroconvertion in pigs by 2.6 fold (ASSADI-RAD et al., 1995) mainly depositing the oocysts form into the soil or water and, therefore; creating high environmental contamination (ORTEGA-PACHECO et al., 2011). It can be concluded that the data obtained in this study is a warning of the risks of local *T. gondii* infection and transmission to the human population.

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