

Serosurvey for *Toxoplasma gondii* in dogs in Maiduguri, Borno State, Nigeria

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Abstract

The seroprevalence of *Toxoplasma gondii* (*T. gondii*) antibodies in dogs in Maiduguri, the capital of Borno State, Nigeria, was determined using the Latex Agglutination Test (LAT). Antibodies (LAT titer > 1:64) to *T. gondii* were found in 42 (25%) of the animals examined. Antibody titers in positive dogs ranged from 1:64 (15 dogs) to 1:2048 (3 dogs). There was a significant statistical difference ($P < 0.05$) between age groups of dogs, the prevalence being higher in dogs ≥ 3 years ($\chi^2 = 13.73$ $P = 0.0002$, OR 2.80 CI95% 1.28-6.13 $P = 0.008$). Pure Alsations and their crosses were less likely to be seropositive (OR cross breed 0.28 CI95% 0.13-0.61 $P = 0.001$, OR Alsatian 0.16 CI95% 0.04-0.58 $P = 0.002$). The high prevalence of *T. gondii* infection that we found in dogs suggests a need for a larger survey to determine the national prevalence and identify possible risk factors in different agro-climatic zones. Such a study will help in formulating nation-wide control measures for toxoplasmosis.

Key words: *Toxoplasma gondii*, seroprevalence, dogs, Borno State, Nigeria

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Introduction

Infection with the protozoan *Toxoplasma gondii* is one of the most common parasitic infections of man and other warm-blooded animals [1-3]. The main route of infection is through the ingestion of oocysts excreted in the feces of cats, which are the definitive host. Infections can also occur by ingestion of cysts in the muscles and tissues of intermediate hosts [4]. As they are definitive hosts, free-roaming cats can be used as sentinels for the environmental spread of *T. gondii* in densely built urban areas [5]. Although dogs do not produce *T. gondii* oocysts like cats, outdoor dogs can become infected by oocysts from soil contaminated with *T. gondii* and mechanically transmit oocysts [6]. Further, the fur of dogs that have come in contact with cat faeces may be a vector for transmission of oocysts to humans [7]. Although primary toxoplasmosis in dogs is rare, the prevalence of *T. gondii* antibodies in canine populations can be an indicator of environmental contamination and the risk of toxoplasmosis to humans [8-11].

Recently there has been increased interest in keeping dogs in major Nigerian cities, for security, as

pets, or to hunt for game popularly known as bush meat. Some people breed and sell dogs for income while in some areas they form a good source of animal protein for people. The level of management and care depends largely on the intended use and the social or economic status of the owners. Exotic breeds, especially Alsations, are owned by more affluent people and security agencies such as the police; exotic cross-breeds are owned by the middle class; and low-income earners generally have mongrels which are used for hunting. The exotic breeds and their crosses are usually housed and well cared for unlike the mongrels that roam freely. Recent surveys of *T. gondii* antibodies in dogs have shown country variations with 8% in Taiwan, 9% in Thailand, and 89% in Brazil [9,11-12]. No data concerning the prevalence of *T. gondii* in dogs in Maiduguri, Borno State, Nigeria, are available.

The aim of our study was to determine the seroprevalence of *T. gondii* in dogs in Maiduguri, Borno State, Nigeria, using the Latex agglutination test. This is the first serological survey for *T. gondii* antibodies in dogs in a Nigerian city.

Table 1. Seroprevalence of *T. gondii* in dogs (n = 168) from Maiduguri, Borno State, Nigeria, split by gender, age, breed and habitat.

Variable (CI95%)	n P	Relative Distribution (%)	LAT Positive	Prevalence (%)	OR
Gender					
Male	60	36	10	17	1.00
Female	108	64	32	30	2.10
(0.95-4.66)	0.06				
Age group (years)					
6 mo -1yr	23	14	4	17	1.00
>1≤3	104	62	21	20	1.2
(0.37- 3.91)	0.75				
>3	41	24	17*	42	2.80
(1.28- 6.13)	0.008				
Breed					
Mongrel	62	37	26	42	1.00
Alsatian Cross	77	46	13*	17	0.28
(0.13-0.61)	0.001				
Pure Alsatian	29	17	3*	10	0.16
(0.04- 0.58)	0.002				
Habitat					
Indoor with limited access to outside	32	19	4	12	1.00
Free access to outside	136	81	38*	28	2.71
(0.89-8.27)	0.07				
Total	168	100	42	25	

* Values with asterisk are statically significant.

Materials and methods

The location of Borno state, the study area, has been described elsewhere [10]. A hundred and sixty-eight dogs were randomly selected from different parts of the city and 5 ml of blood were collected by venipuncture. Blood was allowed to clot, then it was centrifuged, and the serum collected into cryovials and labeled. Sera was stored at -20 °C until further examination. Data such as age, breed, sex, and access to outdoor environment were noted. Dogs were classified as mongrel, Alsatian cross or pure Alsatian.

Serology

The presence of *T. gondii* antibodies was analyzed by the Latex Agglutination Test (LAT) kit (TOXOREAGENT - Mast Diagnostics, Mast House, Derby Road, Bootle, L20 1EA, UK) according to the manufacturer's instructions. The cut-off titer was taken as 1:64 according to the manufacturer's instructions, and an end point titer was established for positive samples.

Data analysis

Chi-square and Fisher's exact tests were used to compare seroprevalence values relative to gender, age, breed as well as access to outdoor environment. Odds ratios (OR) at confidence intervals (CI95%) were used to determine possible factors of exposure. Analyses were done with Statistix 8, and MedCal statistical softwares, with a probability (p) value < 0.05 as statistically significant.

Results

A seroprevalence of 25% (42/168) was recorded in dog samples examined by LAT at a cut-off titer of 1:64 (Table 1). The prevalence in females (30%; 32/108) was higher than in males (17%; 10/60) but the difference was not statistically significant. Positive titers ranged from 1:64 (15 dogs) to 1:2048 (3 dogs). Prevalence increased significantly with age ($\chi^2 = 13.73$, $P = 0.0002$) and dogs ≥ 3 years were significantly more likely to be seropositive than those ≤ 1 year. Mongrels had significantly higher ($P < 0.05$) prevalence (41.9%) than Alsatian crosses (16.9%) and pure Alsatis (10.3%). The risk of infection was significantly lower in pure Alsatis

and Alsatian cross-breeds than in mongrels. The prevalence of anti *T. gondii* antibodies was higher (28%) in dogs that have free access to the outdoors than those confined indoors (11.8%) and they were 2.7 times more likely to be exposed to *T. gondii* (Table 1).

Discussion

Because of the great importance of *T. gondii* as a zoonotic agent, public health organisations, such as the World Health Organisation, have repeatedly advised the collection of accurate epidemiological data on this parasite [2]. For our serological survey for *T. gondii* antibodies in dogs in Maiduguri, the capital of Borno state, Nigeria, we used the LAT which is widely available and has been evaluated as a screening test [11-13].

We recorded a seroprevalence of 25% which is much lower than the 89% recently reported in Brazil [11] but higher than the 8% reported in Taiwan [10] and 9% in Thailand [9]. In our study, the sex of dogs was not significantly associated with seroprevalence, but age and breed were significantly associated and this has been discussed by several other investigators [2,5-8,17,20]. Age is directly related to the rate of exposure to the sources of *T. gondii* infection. From our experience, quality of care by the owners is related to the breed of a dog. Pure Alsations are expensive and usually owned by more affluent people for security purposes. Some people breed and sell them to individuals or government agencies. These dogs are usually provided with good food and kenneling and have limited access to outside environment, which limits their exposure to *T. gondii* in the soil and in animals such as rodents which may be preyed upon for food. Mongrels, in contrast, generally receive little attention from their owners and are commonly exposed to risk factors for *T. gondii*. The highest antibody titers we found were (three at 1:2048) in adult (> 1 year to > 3 years) mongrels with free access (stray) to the outdoor environment, which, as previously reported, is a risk factor [17-20]. This suggests recent infection or ingestion of a high infectious dose of *T. gondii*.

In conclusion, our study has shown *T. gondii* infections in domestic dogs are prevalent in northeastern Nigeria. Taking into account the risk factors we identified, control measures should include restricting access to the outdoors and feeding the animals to prevent them from preying on animals that might be intermediate hosts. These measures

should lower the rate of exposure in dogs and may consequently prevent infection in people.

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