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Cross-sectional serological study of canine *Leishmania* infection in Fortaleza, Ceará state, Brazil

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Abstract

Visceral leishmaniasis (VL) is one of the most important reemerging parasitic disease in the world. The domestic dog is the main reservoir in urban environments. The aim of this work was to extend the knowledge on canine *Leishmania* infection in the city of Fortaleza in northeastern Brazil, identifying the risk factors inherent in dog susceptibility to the infection. Two populations were analyzed, domestic dogs from clinics and the Veterinary Hospital Unit of Ceará State University and stray dogs captured by the Center for Zoonosis Control in Fortaleza. Blood samples were collected and centrifuged and the sera were stored at −20 °C. ELISA, with soluble crude *Leishmania chagasi* antigens (LTCC – WDCM731) was used for diagnosis. A total of 1381 samples were tested, 750 from domestic and 631 from stray dogs. The seroprevalence of canine VL was 21.4% (135/631) in stray dogs and 26.2% (197/750) in domestic dogs. The seroprevalence of *Leishmania* infection in the six administrative regions of the city (*Secretarias Executivas Regionais*, or SER) among stray dogs was highest in SER V, representing 31.4% of the cases, with large dogs more infected (27.7%). Among domestic dogs *Leishmania* infection was most prevalent in SER V (38.5%) and VI (37.6%). The dogs' age (1–6 years), large size, environment with dense vegetation and presence of clinical signs compatible with *Leishmania* infection were associated with the illness in domestic dogs. The frequency of the infection varied seasonally. The seroprevalence was greatest in July and December. These results confirm Fortaleza is an endemic area for canine VL and suggest some variables associated with increasing infection risk in dog populations.

Keywords: *Leishmania*; Seroprevalence; Risk factors; Visceral leishmaniasis; Northeastern Brazil

1. Introduction

Visceral leishmaniasis (VL), caused by *Leishmania chagasi* (synonym *Leishmania infantum*) is a serious public health problem. The principal vector in Brazil is the dipteron *Lutzomyia longipalpis* and its reservoir in domestic and peridomestic settings is the dog (*Canis familiaris*), both contributing to maintain the disease in the human population (França-Silva et al., 2005).

VL is endemic in Brazil with the exception of the southern region. The northeastern region concentrates 65% of the human cases registered in the country. As a VL control measure, 23,000 seropositivity levels dogs are euthanized a year in Brazil. In the state of Ceará in northeastern Brazil, the number of seropositive dogs euthanized was 1136 from 2005 through June 2007, out

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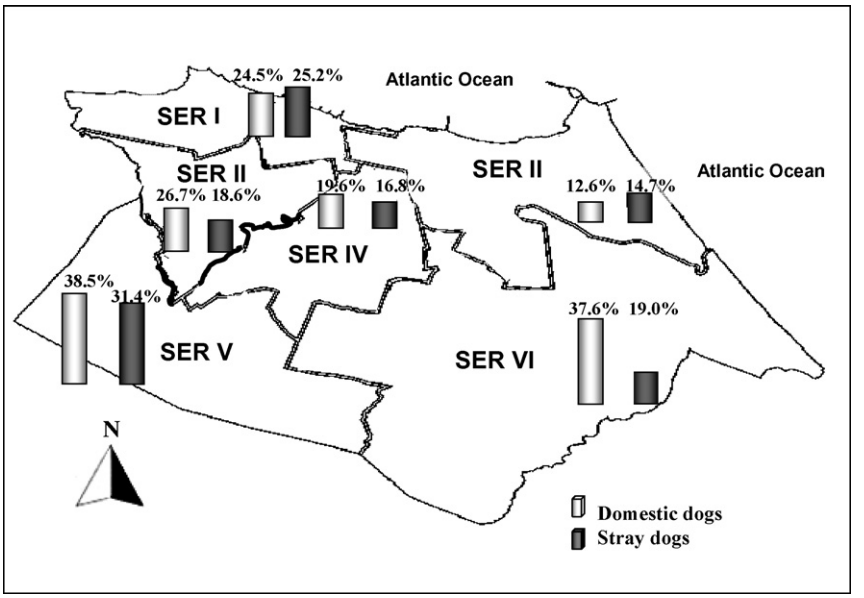

Fig. 1. Seroprevalence of *Leishmania* infection in domestic and stray dogs per Secretariates Executive Regional (SER) of Fortaleza, Ceará, Brazil.

of 31,622 dogs captured by the Center Zoonosis Control (Sesa, 2007).

Environmental degradation and disorderly migration of people have been blamed for the urban spread of VL and the consequent increase in human and canine cases in medium and large cities (França-Silva et al., 2005; Dantas-Torres et al., 2006). This has been observed in Fortaleza, where the disease is becoming more prevalent due to neglect of environmental factors such as maintaining backyards clean and animal breeding places free from organic materials (Sesa, 2007).

The mass elimination of anti-*Leishmania* seropositive dogs is a control measure suggested by the WHO, but it has not helped reducing the incidence of VL in humans (Reithinger and Davies, 2002; Moreira et al., 2004). In the state of Bahia, also in the Brazilian northeast, it has been shown that not all infected domestic dogs can be detected and eliminated by serological investigations, and remaining animals cause the reintroduction of VL in the dog population due to infected animals allowed to roam freely in neighborhoods (Paranhos-Silva et al., 1998).

The search for variables potentially involved in the epidemiology of canine VL has not been very fruitful. Studies of risk factors such as age, sex, breed and type of coat associated with an increased seroprevalence of *L. chagasi* (syn. *L. infantum*) has not produced a consensus (Alencar and Cunha, 1963; França-Silva et al., 2003; Cardoso et al., 2004; Mohebali et al., 2005; Dantas-Torres, 2006; Miranda et al., 2008). Thus, the objective of this work was to determine the seroprevalence of canine *Leishmania* infection in the different administrative regions of Fortaleza and to investigate associated risk factors in dog populations.

2. Materials and methods

2.1. Study area

The study was carried in Fortaleza (3°45′47″S; 38°31′23″W), capital of the state of Ceará. The human population is approximately 2 million, occupying a total area of 313.8 km^2 (Fig. 1). The climate is predominantly equatorial and inter-tropical, with an average temperature of 27 °C and relative air humidity of 77%. Annual rainfall averages about 1600 mm and the rainy season runs from January to July (Prefeitura de Fortaleza, 2006). The monthly rainfall distribution during the experiment was furnished by Fundação Cearense de Meterologia. For administrative reasons, the city is divided into six Regional Executive Secretariates (*Secretarias Executivas Regionais*, or SER) (Prefeitura de Fortaleza, 2006).

2.2. Animals

In the present study 1381 dogs from Fortaleza were analyzed from November 2005 to February 2007.