

Incidence of canine leptospirosis in the metropolitan area of Curitiba, State of Paraná, Southern Brazil

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ABSTRACT

Introduction: The incidence of canine leptospirosis in Brazil needs to be assessed. **Methods:** The same dogs in southern Brazil were sampled over two years to determine the prevalence, incidence and association of canine leptospirosis with various risk factors. **Results:** In 2009, the prevalence was 33 (14.4%) of 228 dogs, with a predominance of serovar Canicola (33.4%). In 2010, 90 dogs were re-evaluated (the remaining dogs were lost to deaths, address changes and donations), and the prevalence was found to be 35 (38.9%) of 90, with the predominant serovar being Icterohaemorrhagiae (51.4%). Moreover, the incidence was 26 of 90 (28.9%), and the disease was statistically associated with age (2009) and street access (2010). **Conclusions:** Our findings revealed instability in the dog population and age to be relevant risk factors for canine leptospirosis.

Keywords: Serology. Prevalence. Dogs.

Leptospirosis is a worldwide zoonosis, with rats playing an important role as reservoirs for the *Leptospira* spp. cycle and for its maintenance in tropical countries¹. Dogs are also infected by zoonotic serovars, such as Canicola and Icterohaemorrhagiae, and dogs have been indicated as potential sentinels for the occurrence of human leptospirosis¹. This disease is highly endemic in Brazil, with more than 3,000 human cases in 2008 and a mortality rate of approximately 10%¹. Curitiba is among the cities with the highest human mortality rates from leptospirosis in the State of Paraná (PR)². In addition, canine leptospirosis in Curitiba and the surrounding areas has also been shown to be highly endemic. Although the seroprevalence of canine leptospirosis has been extensively studied and demonstrated throughout Brazilian territory³⁻⁵, no leptospirosis incidence studies have been conducted in dogs. Accordingly, the aim of the present study was to examine the prevalence, incidence and risk factors of leptospirosis in the metropolitan region of Curitiba-PR, Southern Brazil.

A cohort study was conducted in May 2009 and May 2010 in Pinhais City, a metropolitan area of Curitiba, State of Paraná, Brazil. The Bonilauri neighborhood, where the study

was performed, presented a low-income and homogeneous population that had access to electric power and sewer and garbage services but that still suffered from occurrences of flooding in 2009 and 2010. The study received technical and official support from the Zoonosis Control Center (ZCC) of Pinhais City and was approved by the city's Secretary of Health.

A questionnaire was distributed to dog owners to obtain information regarding the dogs' prior blood sampling in both years. The variables analyzed included sex, age, street access, environmental characteristics (great, good, regular and poor) and body condition (obese, normal, thin and cachectic). The size of the sample was based on a population of 500 dogs⁶, with precision of 5% and a confidence level of 95%, and information was obtained for a minimum number of 217 dogs. This sample was representative of the dog population in the neighborhood. The risk factors were calculated regarding a status of reagent or not reagent, and analysis according to serovar was not performed.

In 2009, 228 dogs were sampled, and only 90 (39.5%) of 228 dogs were re-sampled in 2010. Of the missing dogs that had been previously sampled, 34 (24.6%) of 138 had died, the owners of 23 (16.6%) of 138 did not permit re-sampling, 25 (18%) of 138 had changed addresses, 16 (11.6%) of 138 had no owner at the household, 14 (10.1%) of 138 provided insufficient samples, 12 (8.7%) of 138 were donated, 8 (5.8%) of 138 were reported missing by their owners, and 6 (4.3%) of 138 were not sampled due to the aggressiveness of the dog.

A microscopic agglutination test (MAT) was performed at the Center of Zoonosis Research of São Paulo State University, using 12 serovars, including Australis, Bratislava, Autumnalis,

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Canicola, Cynopteri, Djasiman, Grippytyphosa, Copenhageni, Icterohaemorrhagiae, Pomona, Pyrogenes and Hardjo, with a titer of 100 considered to represent the cut-off. The serological results and questionnaire data were analyzed using the Epi Info software, version 3.5.2 (Center for Disease Control and Prevention, Atlanta, GA, USA). The statistical association was determined using the chi-square test, and the intensity was assessed using odds ratios (ORs) (significance was indicated by $p < 0.05$).

In 2009, 33 of 228 dogs were reagent, with a prevalence of 14.4% (10.2%-19.7%), and in 2010, 35 of 90 dogs were reagent, with a prevalence of 38.9% (28.8%-49.7%). The most prevalent serovars were Canicola in 2009 (11/33 [33.4%]) and Icterohaemorrhagiae in 2010 (18/35 [51.4%]) (**Table 1**). Significantly more dogs younger than one year of age (15/55) were found to be reagent than dogs that were older than one year of age (16/149) (OR=3.12 [1.42-6.85] and $p=0.003$) (**Table 2**). In addition, there were 26 new seroconversions for any serovar in the dog population, for an incidence of 28.9%. These data were confirmed by the observation that the prevalence in 2010 was more than double that observed in 2009.

Studies of canine leptospirosis seroprevalence have shown a distribution of this zoonosis throughout Brazil, ranging from 6.6% to 85%. In particular, the seroprevalence values have been reported to range from 10.5% to 34.8% in the southern region of Brazil, between 6.6% and 17.9% in the southeast, between 10% and 30.9% in the midwest, at 27.3% in the north and between 20% and 85% in the northeast. The most prevalent serovars have been Canicola, Copenhageni and Pyrogenes⁴⁻⁸. Serology for leptospirosis lasts three months for any serovar. In the current study, the difference between Canicola and Icterohaemorrhagiae was due to the animals' reexposure to the bacteria during the following year, rather than the maintenance of serology for either serovar during this period⁹. To the authors' knowledge, no data are available in the literature concerning the incidence of canine leptospirosis.

Predisposition or resistance to infection due to bacterial agents is linked to the age of the animal, as confirmed in this study by the prevalence. The dog is considered to be a sentry for the detection of the bacteria in the environment, and the local ecology determines the incidence of the disease¹⁰. Thus, the monitoring of both ill and healthy animals can increase

TABLE 1 - Results of the serovar analyses using serology in dogs in 2009 and 2010, Pinhais, State of Paraná, Brazil.

	2009		2010	
	n	%	n	%
Serovars				
Australis	1	3.0	0	0.0
Canicola	11	33.4	6	17.1
Copenhageni	4	12.1	0	0.0
Icterohaemorrhagiae	0	0.0	18	51.4
Pyrogenes	2	6.0	1	2.8
Co-infections				
Australis and Icterohaemorrhagiae	0	0.0	1	2.8
Autumnalis and Pomona	0	0.0	1	2.8
Canicola and Copenhageni	1	3.0	0	0.0
Canicola and Grippytyphosa	1	3.0	0	0.0
Canicola and Pyrogenes	6	18.2	1	2.8
Copenhageni and Grippytyphosa	1	3.0	0	0.0
Copenhageni and Icterohaemorrhagiae	3	9.0	1	2.8
Icterohaemorrhagiae and Pyrogenes	1	3.0	1	2.8
Bratislava, Copenhageni and Icterohaemorrhagiae	0	0.0	1	2.8
Canicola, Copenhageni and Icterohaemorrhagiae	0	0.0	1	2.8
Copenhageni, Icterohaemorrhagiae and Pyrogenes	2	6.0	0	0.0
Australis, Bratislava, Autumnalis, Cynopteri, Grippytyphosa and Icterohaemorrhagiae	0	0.0	1	2.8
Autumnalis, Bratislava, Cynopteri and Grippytyphosa	0	0.0	1	2.8
Total	33	100.0	35	100.0

TABLE 2 - Stratified results according to dog sex, age, street access and environmental characteristics in 2009 and 2010, Pinhais, State of Paraná, Brazil.

	2009			2010		
	reagents n/total (%)	OR (CI)	p	reagents n/total (%)	OR (CI)	p
Sex						
male	20/124 (16.1)	1.24	0.57	22/51 (43.1)	0.63	0.30
female	13/91 (14.3)	(0.59-2.59)		13/39 (33.3)	(0.26-1.51)	
unanswered*	0/13 (0.0)			0/0 (0.0)		
Age (years)						
up to one	15/55 (27.3)	3.11	0.003			
older than one	16/149 (10.8)	(1.42-6.85)		**		
unanswered*	2/24 (8.3)					
Street access						
yes	17/95 (17.9)	0.73	0.45	18/35 (47.4)	0.44	0.05
no	16/130 (12.3)	(0.31-1.69)		17/54 (31.5)	(0.18-1.07)	
unanswered*	0/3 (0.0)			1/1 (100.0)		
Environmental characteristics						
excellent and good	10/82 (12.2)	0.67	0.32	11/34 (32.3)	1.71	0.24
regular and poor	23/133 (17.3)	(0.30-1.49)		23/51 (45.1)	(0.69-4.24)	
unanswered*	0/13 (0.0)			1/5 (20.0)		
Body condition						
obese and normal	25/170 (14.7)	1.55	0.24	26/69 (37.7)	1.47	0.47
thin and cachectic	8/46 (17.4)	(0.74-3.26)		8/17 (47.0)	(0.50-4.28)	
unanswered*	0/12 (0.0)			1/4 (25.0)		

n: number of positive samples; OR: odds ratio; CI: confidence interval; *Unanswered data were not considered. **In 2010, all of the animals were older than one year of age.

prevention and reduce both environmental contamination and the number of cases of leptospirosis.

This study revealed instability in the dog population, with a great loss of animals during the study period. In addition, the prevalence of the seroreagent increased from year to year, and the age of the dogs was found to be a relevant risk factor for infection, demonstrating that the supervising and monitoring of dogs in urban areas are important factors in the control of zoonoses.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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