



## Insights on seroprevalence of leptospirosis in dogs and cats from people with animal hoarding disorder profile in a semiarid region of Brazil

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**ABSTRACT:** Animal hoarding disorder, especially dogs and cats, is a complex issue that occurs in almost all communities, and it is necessary to collect data that contribute to the understanding of leptospirosis within the One Health initiative. In order to determine the seroprevalence of *Leptospira* sp., 71 dogs and 39 cats from 33 people with animal hoarding profile in the municipality of Patos, state of Paraíba, semi-arid region of Northeastern Brazil were evaluated by using the microscopic serum agglutination test (MAT) as diagnostic test. Thirty-eight animals (34.5%; 95% CI = 25.7 – 43.4%) were seroreactive, with 46.5% in dogs and 12.8% in cats ( $P < 0.01$ ), with the highest frequency of the Icterohaemorrhagiae serogroup in both species. The high seroprevalence reported suggests the need for public policies for this vulnerable population in order to prevent the transmission of zoonoses.

**Key words:** *Leptospira* sp., One Health, companion animals, public policies.

### Percepções sobre a soroprevalência de leptospirose em cães e gatos de pessoas com perfil de acumuladores de animais em uma região semiárida do Brasil

**RESUMO:** O transtorno de acumulação de animais, principalmente de cães e gatos, é uma questão complexa que ocorre em quase todas as comunidades, sendo necessário o levantamento de dados que contribuam para a compreensão da leptospirose dentro da iniciativa Saúde Única. Com o objetivo de determinar a soroprevalência de *Leptospira* sp. em cães e gatos provenientes de acumuladores de animais foram utilizados 71 cães e 39 gatos de 33 acumuladores do município de Patos, estado da Paraíba, semiárido do Nordeste brasileiro, utilizando-se o teste de soroaglutinação microscópica (SAM) como teste de diagnóstico. Trinta e oito animais (34,5%; IC 95% = 25,7 – 43,4%) foram sororreativos, sendo 46,5% em cães e 12,8% em gatos ( $P < 0,01$ ), com maior frequência do sorogrupo Icterohaemorrhagiae em ambas as espécies. A alta soroprevalência encontrada sugere a necessidade de políticas públicas para esta população vulnerável no sentido de prevenir a transmissão de zoonoses.

**Palavras-chave:** *Leptospira* sp., Saúde Única, animais de companhia, políticas públicas.

Leptospirosis is a zoonotic disease with worldwide distribution caused by bacteria of the genus *Leptospira* that are eliminated in the environment, persisting for months in moist soils, water and accidentally transmitted to humans (KO et al., 2009). In endemic areas, asymptomatic dogs and cats shed leptospires commonly, so this role and public health impact cannot be neglected (SANT'ANNA et al., 2017; CHAN et al., 2014). The main serogroups reported in dogs and cats worldwide are Canicola and Australis, respectively, and both serogroups have zoonotic potential. Serovars belonging to the

Icterohaemorrhagiae serogroup remain important incidental infections of dogs and cats globally; however, differences in the predominant incidental infections differ elsewhere; e.g., in Japan, Hebdomadis infection has emerged as the major infection in dogs, while in Brazil, Canicola, and Icterohaemorrhagiae infections remain important (OLIVEIRA et al., 2012; KOIZUMI et al., 2013; ELLIS, 2015; PINTO et al., 2017; MURILLO et al., 2020). The sentimental relationships of man with dogs and cats, associated with the increase in the population of these animals, allow the transmission of zoonoses, such as leptospirosis.

In this context, hoarding disorder (HD) of animals, especially dogs and cats, is a complex issue that occurs in almost all communities (PALOSKI et al., 2017; POLAK et al., 2014). Animals are subjected to inadequate nutrition, sanitation, shelter and veterinary care, predisposing them to the occurrence of infectious diseases, including those with zoonotic potential. In southern and southeastern Brazil, reports of dogs and cats involving HD cases indicated seropositive animals as possible potential sources of infection (CUNHA et al., 2019; CUNHA et al., 2022).

Greater attention has been given from the scientific community to animal HD, so it is necessary to collect data that contribute to the understanding of leptospirosis in the context of animal, human and environmental health, providing an opportunity to improve multidisciplinary action within the One Health initiative. Therefore, this study determined the seroprevalence of *Leptospira* sp. in dogs and cats from people with animal HD profile in a semi-arid region of Northeastern Brazil.

The study was carried out in the municipality of Patos, state of Paraíba, semi-arid region of Northeastern Brazil. After a survey of denouncements of animal hoarders conducted by the sanitary surveillance and information from community agents, the suspect households were visited. For the characterization of animal HD profile the history, individual opinion and household situation were evaluated, as well as the addressing of criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (AMERICAN PSYCHIATRIC ASSOCIATION, 2014) was provided.

Blood samples were collected from adult and not vaccinated dogs and cats in the period of October 2020 to March 2021, excluding pregnant females and animals < four months old. Anti-*Leptospira* sp. antibody detection was made by the microscopic agglutination test (MAT) (GALTON et al., 1965; COLE et al., 1973; OIE, 2018) using a collection of 20 serovars belonging to different serogroups of five species provided by the Laboratory of Veterinary Bacteriology of the Fluminense Federal University, Niterói, Rio de Janeiro, Brazil, and originated from the Pasteur Institute, France: *L. interrogans* serovars Copenhageni, Canicola, Sentot, Bataviae, Autumnalis, Hardjoprajitno, Icterohaemorrhagiae, Pomona, Hebdomadis, Pyrogenes and Bratislava; *L. santarosai* serovars Guaricura and Shermani; *L. borgpetersenii* serovars Javanica, Whitcombi and Castellonis; *L. kirschneri* serovars Butembo and Grippytyphosa; *L. biflexa* serovars Patoc and Andamana. Titers were determined

as the highest serum dilution in which at least 50% of the agglutinated leptospire were obtained for each serogroup, and animals were deemed positive when they showed titers  $\geq 100$  (cut-off). The comparison of prevalence between animal species was performed using the chi-squared test with the significance level of 5%, using the R environment and RStudio interface.

Thirty-three households were identified and blood samples were collected from 71 dogs (44 females and 27 males) and 39 cats (26 females and 13 males), totaling 110 animals. Twenty-two households had dogs, five cats and seven dogs and cats, and animals lived together in all households. The average number  $\pm$  standard deviation of animals per residence were as follows: dogs ( $5.3 \pm 4.4$ ) and cats ( $11.4 \pm 14.5$ ). There were apparently healthy animals, but clinical signs such as thinness, nasal/ocular secretion and dermatological lesions were observed. The housing conditions varied from large to small environments with trashes, piled up objects, improvised feeders, presence of urine and fecal waste and food scraps. Absence of leptospirosis vaccination, lack of diagnosis and treatment of sick animals, precarious water and food supply, high density of animals in households, lack of knowledge of the origin of the animals and potential circulation of rodents were also observed.

Of the 110 animals sampled 38 (34.5%; 95% CI = 25.7 - 43.4%) animals were seroreactive for *Leptospira* sp. The frequency of seroreactive animals was 46.5% (33 animals) for dogs and 12.8% (five animals) for cats, with statistical difference between species ( $P < 0.01$ ). Of the 32 dogs in which it was possible to determine the most likely serogroup 26 (81.3%) were seroreactive for the Icterohaemorrhagiae serogroup, followed by Canicola and Autumnalis (three animals for each serogroup; 9.4%). In cats, the Icterohaemorrhagiae serogroup was the most frequent (four animals; 80%), followed by Pomona in one (20%) animal.

Despite the adverse environmental conditions for the survival of leptospire in semi-arid regions, the high frequency of seroreactivity found in this survey indicates the exposure of *Leptospira* sp. in dogs and cats from people with HD profile in semi-arid conditions. In previous surveys in the same region the seropositivity was lower in stray dogs (20%; BATISTA et al., 2004) and domiciled dogs (7.7%; FERNANDES et al., 2018), and in stray/domiciled cats (11%; ALVES et al., 2003).

Differently, in the southern and southeastern regions of Brazil, lower frequencies were described (6% and 20% in dogs, and 8.3% in

cats) (CUNHA et al., 2022; CUNHA et al., 2019). In this context, it is suggested that several factors may contribute to these differences, including geographic location, type of housing, level of health care provided by official health services (POLAK et al., 2014), and occurrence of synanthropic animals carrying leptospire (FERNANDES et al., 2018).

In fact, the *Icterohaemorrhagiae* serogroup as being more common in both species may indicate the involvement of the main maintenance hosts of this serogroup, which is *Rattus norvegicus*, in addition to *Rattus rattus* and *Mus musculus*, which may shed pathogenic leptospire (FERNANDES et al., 2018). It should be noted that the deficient sanitary conditions reported in animal HD environments can predispose to rodent infestation (CUNHA et al., 2022).

Canicola serogroup was the second most frequent in dogs, which reinforces the risk of intradomiciliary infection for humans, a fact that has been previously reported (BENITEZ et al., 2021). Autumnalis serogroup has already been reported in severe cases of canine leptospirosis (SANTOS et al., 2021), as well as being described as the second most frequent in stray and public shelter attended dogs (MIOTTO et al., 2018). In Japan, two cases of leptospirosis in humans caused by the serogroup Autumnalis were reported (KOIZUM et al., 2020).

In cats, Pomona serogroup was the second most frequent, and pigs are deemed maintenance hosts for this serogroup (FERNANDES et al., 2018). It should be noted that it is common in small and medium-sized cities in the Northeastern Brazil the circulation of pigs on urban environments (BRASIL et al., 2014), suggesting that animals, before being sheltered by accumulators, had contact with pigs in the urban environment, which suggests a possible risk of leptospire transmission among animal species (MASCOLLI et al., 2016).

The characteristics observed in the cases of people with animal HD profile in the present survey are relevant to the epidemiological chain of leptospirosis, such as the absence of leptospirosis vaccination; lack of diagnosis and treatment of sick animals; precarious water and food supply; high density of animals in households; lack of knowledge of the origin of the animals; and potential circulation of rodents. Thus, leptospirosis needs to be monitored and its risks evaluated in these environments (BRASIL et al., 2018), in which the transmission of the disease can be potentiated, contributing to the occurrence of infection in individuals directly (animal hoarder, neighbors and animals) and indirectly (professionals and volunteers) involved in the context of animal HD.

Therefore, the results obtained suggest leptospirosis as a concern in the One Health context in dogs and cats maintained in semi-arid environment, and points to the need for public policies for this vulnerable population in order to prevent the transmission of zoonoses, as well as reinforce the exposure of these animals to rodents, reservoirs of *Icterohaemorrhagiae* serogroup, with risks to animal health and highlighting the risk for human transmission.

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## BIOETHICS AND BIOSSECURITY COMMITTEE APPROVAL

This study was approved by the Animal Ethics Committee (CEUA/CSTR/UFCG) under protocol no. 051/2019, and Brazil Platform Ethics Committee under number CAAE 17274719.5.0000.5182.

## AUTHORS' CONTRIBUTIONS

All authors contributed equally for the conception and writing of the manuscript. All authors critically revised the manuscript and approved of the final version.

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