



Longitudinal Analysis of Canine Leptospirosis Epidemiological Surveillance in Minas Gerais, Brazil

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Abstract

Leptospirosis is a disease with a wide global distribution, capable of infecting animals and humans. It is transmitted by bacteria of the genus *Leptospira* and manifests mainly in places with poor sanitation, garbage accumulation, and floods. According to the Ministry of Health, the main transmitters of leptospirosis are rodents, which do not develop the disease, but when infected eliminate the live bacteria into the environment, contaminating water, soil, and food. This study aimed to analyze the epidemiological surveillance situation of leptospirosis in dogs in the state of Minas Gerais, with emphasis on the Alto Paranaíba and Triângulo Mineiro regions, and to address the epidemiological indicators of incidence, morbidity, mortality, and lethality in the period between 2015 and 2025. The study revealed a scarcity of information on leptospirosis in dogs, which limits the understanding of the epidemiological situation of the disease not only in the delimited region but throughout Minas Gerais. This highlights that leptospirosis remains under-researched, with a scarcity of updated and standardized epidemiological data. The results reinforce the need to expand regional research and strengthen surveillance, awareness, and prevention actions focused on animal and public health.

Keywords: Leptospirosis; Floods; Public Health

Introduction

Leptospirosis represents a complex infectious disease of global importance, which can infect humans and animals [7]. Transmitted by bacteria of the genus *Leptospira* through direct contact with contaminated soil or water, places with deficiency or absence of basic sanitation are the main sites of manifestation of leptospirosis, as well as places with accumulation of garbage, floods or other relatable environmental factors [8]. The genus *Leptospira* is divided into pathogenic strains (*L. interrogans sensu lato*) and saprophytic strains (*L. biflexas sensu lato*) [1]. Also

according to Araújo [1], there are 13 pathogenic *Leptospira*s and more than 260 serovars, with the serovar canicola and the serovar icteroarmorrhagia being the most common to infect dogs.

The incidence of *Leptospira* in rainy periods is higher, due to the trend in increasing floods and rainfall, since *Leptospira*s need water to survive. Thus, the prevalence is higher in tropical regions [1]. Domestic animals and humans behave as accidental carriers of the bacterium, and can become infected and develop the disease; Dogs can be a source of infection and a reservoir, with a high potential for transmission of the disease to the human species. According to

Araújo [1], serological and microbiological and molecular tests are used for diagnosis, in addition to the use of anamnesis, apparent clinical signs and hematological tests of the animal to conclude the final diagnosis.

Leptospirosis is characterized by its initial phase of hematogenous dissemination. As soon as they come into contact with the host, *Leptospira* rapidly promote systemic infection through the bloodstream, reaching and replicating in various tissues (such as the kidney, spleen, liver, central nervous system, eyes, and genital tract). The clinical signs presented will depend on the immune response of the host's body to the infection and to the infective serovar. In the acute phase, symptoms such as anorexic, vomiting, lethargy, fever, abdominal pain, dyspnea, tachypnea, jaundice, oliguria, anuria, and uveitis are frequently observed [10]. Due to the significant impact of leptospirosis on public health and the considerable economic and productive losses associated with the disease, vaccination becomes an essential preventive strategy, contributing to the reduction of the spread of the infectious agent.

According to the Ministry of Health [5], rodents of the species *Rattus novesticus* (rats or sewer rats), *Rattus rattus* (roof rat or black rat) and *Mus musculus* (mouse or catita) are the main carriers of *Leptospira*. If infected, they do not develop the disease, but keep the bacteria alive in the kidneys and eliminate it alive in the environment, which leads to contaminated soils, waters, and food.

Although leptospirosis is potentially lethal, according to Martins [4], the impact of the disease on public health is still underestimated. It is noted that the cases of the disease still have little or almost no visibility, which makes the disease marginalized and practically unknown by the population. Also according to the author, due to the strong association of the disease with poverty, the lack of attention of the public authorities to its resolution and the possible need to demand permanent (or prolonged) treatments after infection, leptospirosis has come to be classified in the international literature as a Neglected Tropical Disease (NTD). This classification refers to diseases prevalent in populations in poor regions, which do not have the economic conditions and/or adequate infrastructure to invest in fighting the disease, in addition to not arousing the interest of large pharmaceutical companies or government authorities for the development of treatments such as vaccines.

Globally, the epidemiology of leptospirosis points to a higher incidence in countries located in tropical and subtropical regions, due to the higher rate of resistance and survival of *Leptospira* in humid and warm climatic circumstances [9]. National epidemiology gains even more importance, given that Brazil is a country with predominantly tropical characteristics.

According to data from the Minas Gerais State Department of Health (SES-MG) in the last three years, there were 276 confirmed cases of leptospirosis in Minas Gerais [2]. Regarding dogs, no recorded data were found on the number of infected or deaths from leptospirosis. Leptospirosis, as it is a zoonosis, has great relevance in the interface between animal and human health. Therefore, understanding the occurrence of infection in dogs helps in epidemiological surveillance and in the prevention of cases in humans.

The objective of this study was to analyze the epidemiological surveillance and epidemiological indicators of leptospirosis in dogs in the state of Minas Gerais, with a focus on the regions of Alto Paranaíba and Triângulo Mineiro. Specifically, we sought to identify studies carried out in the Alto Paranaíba and Triângulo Mineiro regions that report clinical cases or serological data of leptospirosis in dogs; gather information on the incidence, morbidity, mortality, and lethality of leptospirosis in the canine population; estimate the magnitude of canine infection based on available epidemiological data; to discuss the relevance of these findings for the surveillance and control of leptospirosis as a zoonosis of public health importance.

Methodology

The study is a documentary review, of a qualitative descriptive nature. The research aimed to gather and analyze available information on the prevalence and main epidemiological indicators of canine leptospirosis in Alto Paranaíba and Triângulo Mineiro, with emphasis on the last ten years, between 2015 and 2025. The search for materials was carried out through Google Scholar, used as a tool to direct different scientific databases – such as PubMed and the CAPES journal portal. The inclusion criteria included scientific studies published in the last 10 years, and that presented epidemiological data regarding leptospirosis infection in dogs from the Alto Paranaíba and Triângulo Mineiro regions. Studies without geographic or temporal specification and individual case reports without an epidemiological approach were excluded.

During the elaboration of the study, for the exploratory search, initially, the term “leptospirosis in Minas Gerais” was used; However, it was noted that most of the available studies on the condition focus on cases of leptospirosis in humans or cattle, with little scientific production focused on the canine species. In view of this, the research was refined by “leptospirosis Triângulo Mineiro”, “canine leptospirosis”, “leptospirosis in Uberlândia”, “leptospirosis epidemiology” and “leptospirosis prevalence”. Materials published in the last 10 years were prioritized, with a focus on updated and regional studies.

Studies with an exclusive focus on humans or cattle, publications without access to full text, and materials that did not present relevant epidemiological information were excluded. Even after refinement in the research, it became evident that the lack of epidemiological data limits the understanding of the real prevalence of the disease and reinforces the importance of local research.

Results and Discussion

When analyzing the occurrence of leptospirosis in the last 10 years in the Alto Paranaíba and Triângulo Mineiro regions, during the process, a limitation of data on canine leptospirosis

was found around these regions, and in the state of Minas Gerais itself, evidencing the importance of studies on the subject. This limitation highlights the scarcity of systematized information on canine leptospirosis in Alto Paranaíba and Triângulo Mineiro, and reinforces the character of Neglected Tropical Disease (NTD) attributed to leptospirosis, as discussed by Martins [4] in the introduction of this work. Such lack of data not only restricts the situational diagnosis of the disease, but also reflects the low prioritization of public policies aimed at the interface between animal and human health.

The documentary review identified only three studies carried out in the region between the years 2020 and 2023, addressing the occurrence of leptospirosis in dogs under different epidemiological contexts. This quantitative limitation, although restricted, offers subsidies for understanding how the disease manifests itself in different conditions of management and environmental exposure.

After screening, the selected materials were organized in a descriptive table (Table 1), containing information about the authors, study location, year of publication, methodology used, number of animals evaluated, and prevalence.

Authors	Location	Year of publication	Methodology	Number of animals evaluated	Prevalence
ARAÚJO., <i>et al.</i>	Animal shelter in Uberlândia (MG)	2020	Serological test (MAT)	25	0% (no dog reagent)
SOUZA., <i>et al.</i>	Patos de Minas (MG)	2020	Serum collection and serological analysis	138	6.5% (9 reagent dogs)
GOMES., <i>et al.</i>	UFU Veterinary Hospital, Uberlândia (MG)	2023	Serological testing (MAT + qPCR), clinical and pathological evaluation	24	33.3% (8 positive dogs matching the tests)

Table 1: Studies on canine leptospirosis in the Triângulo Mineiro and Alto Paranaíba.

Fonte: Adapted from Araújo., *et al.* (2020); Souza., *et al.* (2020); Gomes., *et al.* (2023).

Araújo’s study [1], conducted in an animal shelter in Uberlândia, evaluated 25 adult dogs, representing 10.5% (25 of 240) of the total population of the shelter, between males and females, using the Microscopic Seroagglutination (SAM) test. None of the animals presented a reactive result, indicating the absence of seropositivity

(0%). The authors of the study attributed the results to the adoption of preventive measures, such as annual vaccination and integrated rodent control, which demonstrates the effectiveness of prophylactic programs even in environments with high population density. Environmental prophylaxis is a determining factor for

the extinction of rodents, since, as pointed out by the Ministry of Health [5], rodents are the main vectors of leptospirosis.

In Souza [11], carried out in the municipality of Patos de Minas, 138 canine serum samples were analyzed by the MAT method (Microscopic Agglutination Test) and 9 positive samples (6.5%) were obtained. With this, different *Leptospira* serovars circulating in the region were identified, demonstrating the diversity of the infection among the dogs evaluated.

Although the positivity rate was considerably low compared to other regions of Brazil, the study reinforces the importance of periodic investigations to identify risk areas and circulation of different serovars. The study was conducted with domiciled animals and no statistically significant associations were observed between infection and risk factors (sex, age, access to the street or presence of rodents).

The study by Gomes [3] evaluated 24 dogs, mostly domiciled, treated at the Veterinary Hospital of the Federal University of Uberlândia with clinical suspicion for leptospirosis, using the MAT and qPCR (Polymerase Chain Reaction) tests. Of the animals analyzed, 6 (25%) were positive in the MAT and 3 (12.5%) in the qPCR, and 1 (4.17%) was positive in both methods. Considering the two tests combined, the total positivity was 33.3% (8/24). Several serogroups of *Leptospira* were detected in the dogs analyzed, confirming the circulation of different variants of the infectious agent in the municipality. Despite the 3-year gap between the study by Souza [11] and Gomes [3], both agree on the diversity of serovars.

The three studies present different contexts, but all of them show the presence of *Leptospira* in canine populations in the regions of Alto Paranaíba and Triângulo Mineiro, with variations in the positivity rate according to the environment (shelter, domiciled dogs or suspected clinical cases). These findings corroborate the role of dogs as potential reservoirs and transmitters of leptospirosis, which highlights the importance of epidemiological surveillance as a preventive measure for public health, in addition to being consistent with the multifactorial nature of the disease, whose occurrence depends on variables such as environmental conditions, population density, and sanitary management.

The results also dialogue with the scenario described by Pozzobon [6], who investigated the occurrence of leptospirosis in

dogs with clinical suspicion of leptospirosis in Santa Maria (RS). In this study, microscopic agglutination (SAM) test reports for leptospirosis of 218 dogs between January 2015 and December 2019 were analyzed. Of the 218 samples, 46.33% were reactive, indicating a prevalence higher than that observed in Alto Paranaíba and Triângulo Mineiro. The difference can be explained by climatic factors, since in Rio Grande do Sul there is higher humidity and rainfall, and the sample profile (symptomatic dogs).

The comparison between the two regions shows how climatic and geographic conditions influence the epidemiological dynamics of the disease, since the state of Minas Gerais has a predominance of semi-humid tropical climate and the South of Brazil a subtropical climate and high rainfall. According to information provided by the Ezequiel Dias Foundation (FUNED) [2], based on data from the Minas Gerais State Department of Health (SES-MG), 276 cases of leptospirosis in humans have been confirmed throughout the state of Minas Gerais, with a predominance in the Center-South Region and in the Triângulo Mineiro, in the last three years. The absence of official records regarding canine leptospirosis highlights an important gap in the surveillance of the disease in the state, reinforcing the need for greater integration between the animal and human health sectors.

Conclusion

Canine leptospirosis not only in the Triângulo Mineiro and Alto Paranaíba regions, but throughout Minas Gerais, remains underinvestigated, with a lack of updated and standardized epidemiological data. The available studies reveal variation in positivity rates according to the environment and management conditions, evidencing the influence of environmental factors and rodent control on the dynamics of infection. The absence of systematized information demonstrates weakness in zoonotic surveillance and makes it difficult to understand the real magnitude of the disease in the Alto Paranaíba and Triângulo Mineiro regions. These findings reinforce the need to expand regional research and integrate animal and human health actions in order to strengthen monitoring and preventive strategies aimed at leptospirosis.

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