

## COVID-19 IN PETS, WHAT DO WE KNOW?

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### ABSTRACT

The COVID-19 caused by the coronavirus 2 severe acute respiratory syndrome (SARS-CoV-2), was first reported in Wuhan, China, starting an outbreak that affected countries around the whole world. The disease leads to simple clinical signs, such as colds common to more serious conditions as pneumonia and severe respiratory insufficiency. It is assumed that the agent was originated from bats in China, considering its as natural reservoirs, however, this relationship is still being investigated, as well as the possible intermediate hosts. Little is known about the relationship of animals with the disease epidemiological cycle, however, until now, the human transmission to companion animals and vice versa, is not yet evidenced. Nevertheless, some care must be considered if the tutors are infected by the disease.

**Keywords:** SARS-CoV-2, dogs, cats, medical clinic.

### INTRODUCTION

Coronaviruses (Covs) are part of an encapsulated RNA (ribonucleic acid) viruses' family, single-stranded, widely distributed among mammals and birds, which was identified in the 1960s, after the discovery of several new human respiratory pathogens (MASTERS, 2006). These viruses have high genetic plasticity due to the accumulation of point mutations and recombination events, enabling the emergence of viral strains with greater virulence, different tissue tropisms and a host range BROWNLEE & SIBLEY, 2020).

In December 2019 in the city of Wuhan-China, was confirmed the first case of the disease named as the new coronaviruses (COVID-19) and in March 2020 it was declared as a pandemic by the World Health Organization (WHO), initiating the outbreak that affects countries around the whole world. The COVID-19 etiological agent was named as Severe Acute Respiratory Syndrome of Coronavirus 2 (SARS-CoV-2) by the International Committee on Taxonomy of Viruses (ICTV) (OIE, 2020; SHI, et al. 2020).

The disease may be characterized by a common cold, pneumonia with acute respiratory failure and other complications such as pulmonary edema, pneumonia with acute respiratory failure and others complications as pulmonary edema, acute respiratory distress syndrome (ARDS) and even multiple organ dysfunction syndrome (MODS) (CHEN, et al. 2020).

Despite the exact origin of COVID-19 still unknown, the first reported cases were linked to the wholesale seafood market in Huanan (southern China), where wild animals (as bats) were

illegally sold (SINGHAL, 2020). Using phylogenetic analysis, were possible to compare the SARS-Cov-2 viral genome and the bat-derived beta coronavirus genome (bat-SL-CoVZC45), identifying a similarity of 89.1% of the nucleotides (WU, et al. 2020).

From the hypothesis that the initial transmission occurred between different species of animals, the concern with companion animals arises. There are still no studies and information verifying that pets have been affected by COVID-19, either that they may be a source of infection for humans. Until moment, among 2,297,217 people confirmed for SARS-CoV-2, just four animals which had contacts with infected people tested positive for this disease. Among these, a cat and two dogs in Hong Kong and other cat in Belgium (AVMA, 2020; OMS, 2020). Thus, proceed the need to elucidate guardians and the community about the information published until moment by reliable sources and the care to be considered with pets.

## DEVELOPMENT

In 2002/2003 a coronavirus of the genus beta and originating from bats affected the China population, mainly Hong Kong city and infected 8422 people, with 916 deaths. Civet, a wild mammal from Asia, was the intermediary host at the virus cycle that was identified as a coronavirus of the Severe Acute Respiratory Syndrome (SARS-CoV). In 2012, the Middle East Respiratory Syndrome coronavirus emerged in Saudi Arabia (MERS-Cov), which is also arising from bats. However, the intermediate hosts were camels and dromedaries, causing 858 deaths and 2494 people affected (SINGHAL, 2020). Currently it is suspected that SARS-CoV-2 also is arising from bats and a possible intermediate host can be the pangolin (XU, 2020). COVID-19 is constantly compared to the 2002 and 2012 outbreaks and the same concern that occurred at that time is currently happening in relation to pets. At the end of the epidemic of 2003, just eight cats and a dog tested positive for the virus and did not identified any animal that has transmitted the disease to humans (WORLD ANIMAL PROTECTION, 2020).

Similarly, to what happened during the SARS-Cov outbreak in 2003, it is assumed that is happening with SARS-CoV-2 now. A jump between species transmitting from an intermediate host (not yet identified) for humans (WHO, 2020). Through the bronchoalveolar lavage (BAL) sampling was suggested that *Rhinolophus* bats (horseshoe bats) would be the reservoir of the disease. Phylogenetic analysis using the complete viral genome identified a similarity of 89.1% nucleotides among the group SARS-type coronavirus (genus beta coronavirus, subgenus sarbecovirus) that were previously found in these bats in China in 2003 (WU, et al. 2020). However, this hypothesis needs to be further analyzed, since a genomic similarity was also recently identified with pangolins, an Asian and African mammal that is in danger of extinction (SINGHAL, 2020). Scientists from the South China Agricultural University identified a 99% similarity of the virus isolated from this specie with the genomic sequence of SARS-CoV-2 and based on this finding, pangolins are suspected to be the intermediate host of the disease (XU, et al. 2020). Through affinity binding analysis to receptor-binding domain (RBD) and to Angiotensin-converting enzyme 2 (ACE2) the bamboo rats were also considered potential hosts. These animals are commonly found in markets and in Chinese cuisine, but for the confirmation of this suspicion, more analyzes must be carried out (GRUBER, 2020).

To identify whether pets can be intermediate hosts of COVID-19 disease some studies were conducted in dogs and cats. The viral replication capacity, seroconversion, and transmission from an infected dog to a healthy one was analyzed through nasal inoculation. The results obtained did not reported the transmission between dogs, and the seroconversion occurred in only two of four dogs that were inoculated with the virus, indicating that dogs have low susceptibility to SARS-CoV-2 (SHI, et al. 2020). It is important to highlight that there are two specific coronaviruses that affected dogs: the canine enteric coronavirus (CCoV), which affects the digestive system of animals and the canine respiratory coronavirus (CRCoV), which has in

common with SARS-CoV-2 the fact that it is of the same genus (Beta coronavirus). For both diseases, vaccines are available for dogs, however, there is no evidence that its offer cross-protection against COVID-19 infection (BROWNLIE & SIBLEY, 2020; WORLD ANIMAL PROTECTION, 2020).

In relation to cats, the results obtained have been more disquieting than in dogs. Of the species investigated until moment, cats and ferrets are the most susceptible to COVID-19, once feline cells have a cellular protein necessary for the entry of the virus (ACE2) very similar than it in humans (SUN, et al., 2020) and may be for this reason these animals can present a clinical picture of the disease (OIE, 2020). After virus inoculation in cats was possible identified an efficient viral RNA replication and the antibody production confirmed by ELISA test. In addition, was possible to identified that there was transmission from an infected cat to a healthy one from aerosols and respiratory drops, indicating that cats are susceptible to SARS-CoV-2 (SHI, et al. 2020). However, according to Saif (2020) the results obtained at laboratory may not coincide with reality. The study was conducted with few animals which were subjected to high doses of the virus COVID-19, which does not represent the actual interactions between people and pets (MALLAPATY, 2020). Cats can be affected by a specific coronavirus, the feline Coronavirus (FCoV), that can cause a mild enteric infection, or a more serious illness known as Cat PIF (Feline Infectious Peritonitis). This strain belongs to the alpha coronavirus genus, different from SARS-CoV-2, without correlation with COVID-19 (ALMEIDA, et al. 2019). Therefore, there is no concrete evidence that infected cats can secrete enough coronaviruses to transmit them to humans. The predominant transmission pathways of COVID-19 are between people and further studies are needed to determine how the virus affected the human population (OIE, 2020).

In Hong Kong, two cases of dogs that were positive for COVID-19 and lived with people already confirmed with the disease were reported. On February 27, 2020 using the Real Time Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) test in a 17 year old German Spitz breed dog were reported as a "mild positive" test for SARS-CoV-2 (ALMENDROS, 2020 and WORLD ANIMAL PROTECTION, 2020). RT-PCR test is sensitive, specific and does not cross react with other dog or cat coronaviruses, the same sample was subsequently repeated, and the results were similar (AVMA, 2020). Specific antibodies to COVID-19 were also evaluated, that initially showed negative results, but after being repeated in late March the results were positive, that is, there was a seroconversion. In mild infections the antibodies may not develop as has been observed in some people with COVID-19, it is then assumed that the immune response developed by the dog could be a true infection caused by human-animal transmission ALMENDROS, 2020).

The German Spitz age is a determining factor, since in these conditions' dogs become very vulnerable to infections, however, no clinical signs related to COVID-19 were reported. Currently, it is uncertain about how the disease interacts with other animals. There are doubts about whether the dog contracted the disease or if just the virus was harbored inside its body, once the dog was near his owner who was infected (WORLD ANIMAL PROTECTION, 2020). In addition, the German Spitz lived with another dog, which showed negative results when tested to this virus (AVMA,2020). The main barrier to a virus infecting a new animal type is the host cell surface. To infect canine cells, SARS-CoV-2 must be able to bind to canine receptors cell. Viruses use ACE2 and TIMPRSS2 proteins to infect cells and even dogs possess these proteins, they are not identical than human proteins, so the agent is not able to use them with the same effectiveness (CADDY, 2020).

The second confirmed case in Hong Kong on March 18, 2020 was a 2-year-old German Shepherd. This dog also developed neutralizing antibodies to the virus, but did not show clinical signs of respiratory disease and did not transmit the virus to another dog that lived together (AVMA, 2020).

Two cats were also confirmed, one in Belgium and the other one in Hong Kong, that both were positive for COVID-19, while the tutors were also positive for this disease. The Hong Kong cat did not manifest any characteristic clinical signs, in contrast to the Belgian cat that presented some respiratory clinical signs but without confirmation that these signs arise from COVID-19 (CADDY, 2020). Limited information is known about the samples in which the viral material was detected, and it is not possible to establish a clear connection between the presence of viral material and clinical signs consistent with coronavirus infection. The cat condition improved nine days after the onset of clinical signs (AVMA, 2020). The isolated cases that were described are being studied, but until now the isolation of the animals has not been necessary.

Despite the above facts the Centers for Disease Control and Prevention (CDC) recommends that infected people limit contact with their pets until there is better information. Social isolation is still the WHO (2020) recommended measure for disease control and prevention, thus, walks with the dogs should be carried out outdoors, in a reduced time, just to meet the animals physiological needs and always avoiding crowded places. Regarding the virus and its ability to infect these animals, veterinary consultations should also be limited to patients with urgent and emergency conditions.

## CONCLUSIONS

The information available until moment showed that companion animals are not part of the epidemiological chain of COVID-19, that is, they are not sources of infection for humans. Although infection of dogs and cats is possible, there is no scientific evidence of the development of significant clinical signs.

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