

COVID-19: Role of Animals in Transmission

Raúl González Salas^{1*}, Lucía Fuentes Jiménez², José Alfredo Guevara Franco³, María Belén Olivarez Yaguar¹, Mildre Mercedes Vidal del Río¹ and Osmaida Estrada Cutiño⁴

¹Universidad Regional Autónoma de Los Andes, Ecuador

²Instituto Tecnológico Superior del Oriente del Estado de Hidalgo. (ITESA), México

³Department Animal Health, University Autónoma de Baja California Sur, México

⁴Department Veterinary Medicine, University of Granma, Cuba

***Corresponding Author:** Raúl González Salas, Universidad Regional Autónoma de Los Andes, Ecuador.

Received: October 12, 2020; **Published:** November 07, 2020

Abstract

The spread of Covid-19 took the form of a pandemic when the WHO declared the day of January 30, 2020 as a global health emergency, after a bibliographic review of the most up-to-date data on humans. It has been determined that beta coronaviruses are the causative agent in the triad of the disease and having bats and/or pangolins as host first, after which it had humans as host. In order to publicize the role of animals in the transmission of COVID-19, a qualitative systematic bibliographic review was carried out, by searching the Medline and Clinical Key databases. Pangolins were found to be a major reservoir of *betacoronavirus*. It is concluded that pangolins are the wild animals most likely to be the causative agent for Covid-19, there is not enough scientific evidence to show that domestic animals can spread SARS-Co2 and cats and ferrets turned out to be the animal species more susceptible to infection.

Keywords: *Animals; COVID-19; Transmission*

Introduction

The disease caused by coronavirus (COVID-19), was identified as the cause of a respiratory outbreak in Wuhan, Hubei province, China as of December 2019. This epidemic has spread to 185 countries in the world, with more than 11 791 confirmed cases and deceased persons. The World Health Organization has declared it a pandemic (WHO, 2020).

The epidemic has progressed through the local outbreak stage and the community transmission stage due to exposure at Wuhan's Huanan Seafood Wholesale Market and is now in the large-scale transmission stage due to the spread of the pandemic. The basic productive number (R0) at the beginning of the epidemic was 2.2, with an average incubation period of 5.2 days. The proportion of critically ill patients was 23.4%, the mortality rate was lower than that of SARS and the Middle East respiratory syndrome, and 96.5% of the deaths occurred in Hubei province, where the outbreak occurred. First. Among them, older men with underlying diseases had a higher mortality rate [1].

Coronaviruses (CoVs) are from the group of positive sense single-stranded RNA viruses, possess envelopes, are highly diverse and cause respiratory, digestive, liver and neurological disorders of varying severity in a wide range of animal species, including humans,

in whom they can cause serious illness. They are grouped into four genera: *Alphacoronavirus*, *Betacoronavirus*, *Gammacoronavirus*, and *Deltacoronavirus*. Regarding the latter, two of them have been of great interest to the scientific community and world health in the last seventeen years: SARS-CoV, which causes severe acute respiratory syndrome and MERS-CoV, responsible for the Middle respiratory syndrome East [2].

Wild animals are essential components of ecosystems, sources of food, contribute to the reconstruction of forests, fertilization of soils, and are also used for medicinal, commercial and cultural purposes. These species are threatened or subject to strong pressure due to anthropic causes [3]. However, there is growing concern about the possible damage that zoonotic diseases can cause to human health.

Wild fauna is considered a source of emerging pathogens that, in certain periods and depending on ecological, socioeconomic or demographic variations, can affect a large number of people [4]. Bats have been shown to be reservoirs of zoonotic viruses with a high pathogenicity profile, including Hendra, paramyxovirus, filovirus, Nipah and coronaviruses similar to SARS and MERS with high mortality rates [5].

Objective of the Study

The objective of the work is to publicize the role of animals in the transmission of COVID-19.

Materials and Methods

A qualitative systematic review related to the role of animals in the transmission of COVID - 19 was carried out in the Medline and Clinical Key databases. Updated epidemiological data were obtained from the WHO and Center for Evidence-Based Medicine web pages.

Results and Discussion

COVID-19 or (SARS-COV-2), was reported for the first time in China, with bats, the probable original hosts, and pangolins as possible intermediate hosts. The current source of the disease is mainly patients infected with SARS-COV-2. According to the latest studies, patients in the incubation period are usually a source of infection, also called asymptomatic carrier patients [2].

The virus is transmitted mainly through respiratory fluids (droplets) and contact, and the generally most susceptible population are people over 50 years of age, adults, young people between 30 and 45, with predisposing diseases, and children under 7 years of age. What started as an epidemic outbreak in Wuhan - China, spread rapidly, resulting in that on January 30, 2020, the Director General accepts the recommendation and declares that the outbreak due to the new coronavirus (2019-nCov) constitutes an Emergency of Public Health of International Importance (ESPII). It is the sixth time that WHO has made such a declaration, since the International Health Regulations (IHR) came into force in 2005 (WHO, 2020).

The WHO has only convened the emergency committee in a few cases, in 2004 to combat avian flu (H5N1) and in 2005 for severe acute respiratory syndrome (SARS). This mechanism also came into effect in 2014 due to an outbreak of poliomyelitis, a disease that was believed to be eradicated, and due to Ebola fever in West Africa. In 2016 it was caused by the Zika virus and in 2019 by Ebola fever in the Democratic Republic of Congo on June 26, 2020, and more recently SARS Cov-2, known as Covid-19 (WHO, 2020).

Having already ruled out human and avian influenza, SARS-CoV and MERS-CoV, the coronavirus responsible for the outbreak in Wuhan has been reported to be a group 2B Betacoronavirus. With a genetic sequence at least 70% similar to SARS-CoV, the WHO named it SARS-CoV-2 (initially 2019-nCoV-2). The pathology that it produces is called coronavirus disease (COVID-19) and its symptoms include fever in more than 90% of cases, malaise, pulmonary infiltrates when performing chest x-ray, dry cough in 80%, dyspnea in 20% and difficulty respiratory rate 15% (WHO, 2020).

The World Health Organization (WHO) uses the term “public health emergency of international concern” (PHEIC) when an outbreak of a disease affects more than one country and currently includes 188 countries. It is because of this situation that an internationally coordinated strategy is required, an aspect that is complemented by the notification of the health emergency by the WHO director general, currently the Ethiopian Tedros Adhanom Ghebreyesus [1].

The basic reproductive number (R_0) at the beginning of the epidemic was 2.2, with an average incubation period of 5.2 days. The proportion of critically ill patients was 23.4%, the mortality rate was lower than that of SARS and Middle East respiratory syndrome (MERS), and 96.5% of deaths occurred in Hubei province, where the outbreak happened first. The initial source of the 2019 novel coronavirus (2019-nCoV) was the Huanan Seafood Market in Wuhan, Hubei Province, China, with pangolins as a possible animal host. Currently, the main source of infection is patients with pneumonia, and asymptomatic carriers can also be infectious [6].

Coronaviruses (CoVs) are positive sense single-stranded RNA viruses that are enveloped, highly diverse and cause respiratory, digestive, liver and neurological disorders of varying severity in a wide range of animal species, including humans, in whom they can cause serious diseases. CoVs are grouped into four genera: Alphacoronavirus, Betacoronavirus, Gammacoronavirus, and Deltacoronavirus [7].

Cortés [2], expressed that two of the Betacoronaviruses have been of great interest to the scientific community and world health in the last seventeen years: the cause of severe acute respiratory syndrome (known as SARS-CoV) and the cause of respiratory syndrome of the Middle East (known as MERS-CoV). According to Manuel Peinado, today there is more than enough scientific evidence to prove that SARS-CoV-2 is a type of viral zoonosis originating in wild animals such as bats and then transmitted through other mammals to humans.

About 70% of the emerging infections in the last 40 years have been zoonoses, that is, infectious diseases caused by bacteria, viruses, fungi or parasites that are transmitted from animals to humans. They can do so through direct physical contact, through air or water, or through an intermediate host. These zoonotic pathogens often do not affect the animals in which they reside, but could pose a huge risk to humans who do not have natural immunity against them [8].

SARS-CoV-2 is closely related to the virus that causes severe acute respiratory syndrome (SARS-CoV-1), which spread around the world almost 20 years ago, and was controlled after causing about 8,000 deaths in China. Scientists have concluded that SARS-CoV-1 differs from SARS-CoV-2 only by several key letter changes in the genetic code of both (WHO, 2020).

From the point of view of the general molecular structure of SARS-CoV-2, it can be said that it is more similar to viruses found in bats and pangolins that had been little studied and which were not known to cause harm to humans.

In the case of SARS-CoV-2, the investigations suggest that the animal was a bat that transmitted the virus to another intermediate animal, most certainly a pangolin according to the genome of the coronavirus found in these animals, which transmitted it up to the humans. According to this hypothesis, the genetic characteristics that make the new coronavirus so pathogenic to infect human cells resided in those animals before jumping to humans; these pathogenic characteristics would have mutated after the virus passed directly or indirectly from a pangolin to humans. Then, already inside the new host, the virus could have evolved to easily penetrate human cells. Once that capacity was developed, the pathogen would be even more capable of spreading between people [9].

A dilemma still to be solved, but one that poses three urgent measures so that an infection of this nature does not recur: monitor coronaviruses that infect mammalian species; ban wildlife trafficking, and reduce human exposure to wildlife by closing markets where live wild animals are sold, measures that have already been adopted by China [10].

Acha and Szyfres [10] state that although bats are probably the reservoir host for SARS-CoV-2, the identity of any intermediate host that may have facilitated the transfer to humans is unknown, the scientists explain in an article published in the journal *Nature*.

However, Rodríguez [11] identified coronaviruses related to SARS-CoV-2 in the samples of five of 18 Malaysian pangolins that had been seized in anti-smuggling operations in southern China. Specifically, the metagenomic sequence identified pangolin-associated coronaviruses that belong to two sub-lines of SARS-CoV-2-related coronaviruses.

Likewise, Rodríguez [11] refers that pangolins are the only mammals other than bats that have been documented as being infected by a coronavirus related to SARS-CoV-2. It is notable that two related lineages of coronavirus are found in these animals which were independently sampled in different Chinese provinces and that both are also related to SARS-CoV-2. This suggests that they may be important hosts for these viruses, which is surprising given the solitary ones, which have relatively small population sizes, reflecting their endangered status.

According to Tsan-Yuk [12], when studying the identification of coronaviruses related to SARS-CoV-2 in Malaysian pangolins, current data show that there is a high probability that these mammals acquired their viruses related to SARS-CoV-2 regardless of bats or other animal hosts [11]. Therefore, its role in the emergence of human SARS-CoV-2 has yet to be confirmed. In this context, it has been explained that it is very remarkable that both coronavirus lineages were obtained from trafficked Malaysian animals, data in Southeast Asia, and that there is a marked lack of knowledge of the viral diversity maintained by this species in regions in the that is indigenous. On the other hand, it is suggested that the degree of transmission of the virus in these populations should be further investigated [10].

On the other hand, coronaviruses, including those related to SARS-CoV-2, are present in many wild mammals in Asia [13]. Although the epidemiology, pathogenicity, the degree of infection between species and the transmissibility of coronaviruses in pangolins have not yet been studied [14], the data presented here suggest that the handling of these animals requires considerable caution and their sale in wet markets should be strictly prohibited. Greater vigilance in their natural environment in China and Southeast Asia [15] is necessary to understand their role in the emergence of coronaviruses and the risk of future zoonotic transmissions [10].

Zhou., et al. [16] that certain coronaviruses that infect animals can be transmitted to humans and then spread between people, although according to the literature the mechanisms are not clarified. This is what happened to the virus that caused the current COVID-19 outbreak, as the virus likely originated in bats. The first reported infections were linked to a live animal market, but the virus is now being transmitted from person to person, in around more than 180 countries [17], leaving as a result countless infected and even it has claimed the lives of hundreds of people [18].

Certain research has shown that domestic animals can be infected in the same way as a human being, however, it should also be noted that there is no evidence that pets can transmit to their owners. The World Health Organization states that there is no evidence that a dog, cat or any pet can transmit COVID-19, which somewhat reassures the population that has a great attachment to these companion animals, but this is not enough for them [11].

According to recent studies, it can be concluded that this virus comes from bats, another theory postulated is that it could have arisen from the pangolin (a species with a high level of illegal trade in China), sold in a known market located in Wuhan, whatever it may have been. its origin, the truth is that the virus managed to spread worldwide. Thanks to extensive research carried out around the world, it was determined that many species are vulnerable to being infected with the virus because they contain the angiotensin-converting enzyme 2 (ACE2), one of them are bats, cats, pigs, sheep, horses, lynxes, pigeons [10].

Shi., et al. [19], refer arguments about contagion to domestic animals, where the story of a dog that currently died and two cats in New York that are currently in recovery stand out, it should be noted that these animals were in contact with people who tested positive for COVID-19, that is, they were infected by their owners, later, studies in Australia showed that the virus within these pets was inactive. On the other hand, the contagion of a four-year-old tiger was reported in the United States, who remains in the Bronx Zoo giving an explana-

tion that it could have been contagion from a caretaker in an asymptomatic state. The way to prevent contagion to pets is to first confirm that the owner has COVID-19, then completely isolate himself from people and in the same way from the pet.

Knowledge of the role of animals in the appearance of this virus, as well as the susceptibility of animals to suffer from COVID-19 or to be able to transmit SARS-CoV-2 is essential since it will allow us to better understand how the current pandemic has been generated, which is essential to adopt adequate measures that prevent the appearance of similar diseases in the future, as recently it became known another type of porcine virus, which ensures a possible pandemic. These studies can also help to identify whether there are potential animal reservoirs that may play an epidemiological role in the maintenance/transmission of SARSCoV-2. And, and also, establish animal models for the study of important aspects of COVID-19, as well as the possible role of domestic species in the current pandemic [18].

However, there is not enough scientific evidence to show that pets could spread SARS-CoV-2. But there is research where cats and ferrets turned out to be the animal species most susceptible to infection. In the case of the latter, SARS-CoV-2 was capable of replicating in the upper respiratory tract without causing signs of serious illness or death, in addition, similar results were obtained in cats, where the transmission of viruses between individuals was also demonstrated through of microdroplets of respiration. In contrast, dogs showed low susceptibility to SARS-CoV-2 infection and pigs, ducks, and chickens none [20,21].

The possible role of animals as mechanical vectors of this virus has also been reported through hair, skin or legs after coming into contact with excretors, that is, when being caressed by a COVID-19 positive person. Although no specific studies have been found in this regard, such a possibility deserves a thorough investigation in order to continue looking for alternatives for the control and possible prevention of the spread of the virus (WHO, 2020).

Conclusion

- Pangolins are the wild animals most likely to be the causal agent for Covid-19.
- There is not enough scientific evidence to show that pets can spread SARS-CoV-2.
- Cats and ferrets were found to be the animal species most susceptible to infection.

Conflict of Interest

No conflict of interest.

Bibliography

1. Quesada C., *et al.* "Coronavirus COVID-19: clinical presentation, diagnosis and treatment". Health Sciences Magazine. Medicine - UNIBE. 3.4 (2020).
2. Cortés M. "Coronavirus as a threat to public health". *Medical Journal of Chile* 148.1 (2020): 124-126.
3. Estrada P., *et al.* "Use value, cultural importance and perceptions on medium and large wild mammals in the Mixteca Poblana. 2018". *Acta Zoológica Mexicana* 34 (2018): e3412131.
4. Cunningham A., *et al.* "One Health, emerging infectious diseases and wildlife: two decades of progress?" *Philosophical Transactions of the Royal Society B: Biological Sciences*. [Royalsocietypublishing.org](https://royalsocietypublishing.org). (2020).
5. Daszak P., *et al.* "Emerging infectious diseases of wildlife-threats to biodiversity and human health". *Science* 287 (2020): 443-449.
6. Velavan T and Meyer C. "The COVID-19 epidemic". *Tropical Medicine and International Health* 25.3 (2020): 278-280.

7. Inca GP and Inca AC. "Evolution of the coronavirus disease (COVID-19) in Ecuador". CSSN 11.1 (2020).
8. Adhikari S., *et al.* "Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review". Springer (2020).
9. Silva J and Marcial Ibo. "SARS-CoV-2 and other emerging viruses and their relationship with safety in the food chain". *Scientia Agropecuaria* 11.2 (2020): 267-277.
10. Acha P and Szyfres B. *Zoonoses and Communicable Diseases Common to Man and Animals Third Edition* Paho.org. (2020).
11. Rodríguez H. "Los pangolines pueden portar diversos coronavirus relacionados con el SARS-CoV-2". National Geographic (2020).
12. Tsan-Yuk T., *et al.* "Identifying SARS-CoV-2-related coronaviruses in Malayan pangolin". *Nature* 583 (2020): 282-285.
13. Ye Q., *et al.* "Epidemiological analysis of COVID-19 and practical experience from China". *Journal of Medical Virology* 92.7 (2020): 755-769.
14. Liu Xing and Za Zhi B. "The Epidemiological Characteristics of an Outbreak of 2019 Novel Coronavirus Diseases (COVID-19) in China". *Zhonghua Liu Xing Bing Xue Za Zhi* 41.2 (2020): 145-151.
15. Lam TTY., *et al.* "Identification of 2019-nCoV related coronaviruses in Malayan pangolins in southern China". *BioRxiv* (2020).
16. Zhou M., *et al.* "Coronavirus disease 2019 (COVID-19): a clinical update". *Journal of Infection* (2020).
17. Sahu K., *et al.* "Trajectory of the COVID-19 pandemic: chasing a moving target". *Annals of Translational Medicine* 8.11 (2020): 694.
18. Zhu N., *et al.* "A Novel Coronavirus from Patients with Pneumonia in China, 2019". *New England Journal of Medicine* (2020): 1-7.
19. Shi J., *et al.* "Susceptibility of ferrets, cats, dogs, and different domestic animals to SARS-coronavirus-2". *Biorxiv Science* (2020): abb7015.
20. Brownlie J. "Conclusive proof needed for animal virus reservoirs". *Veterinary Record* 186 (2020): 354.
21. OMS. Nuevo coronavirus 2019 (2020).

Volume 5 Issue 12 December 2020

© All rights reserved by Raúl González Salas., *et al.*