

Low COVID-19 infection rate in high altitude areas

Baja tasa de infección por COVID-19 en zonas a gran altura

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Mr. Director:

A pandemic is spreading worldwide, which is caused by SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2), which causes COVID-19. It infects cells by recognizing the angiotensin-converting enzyme (ACE2), which is located in diverse organs such as lungs, heart, blood vessels, kidneys and intestines⁽¹⁾.

The major conditions caused by this disease are at the level of the lung epithelium, since the ACE-2 receptor acts as a vasopressor, balancing the action of its counterpart, the ACE-1 enzyme, which acts as a vasoconstrictor, and both form the renin-angiotensin system (RAS) which is very sensitive to oxygen⁽²⁾.

Under adequate or normal oxygen conditions, the RAS system is regulated by the dynamic equilibrium between ACE-1 and ACE-2 expression. However, under chronic oxygen deficient conditions, ACE-1 is regulated by hypoxia-inducible factor 1 (HIF-1) in the pulmonary artery smooth muscle cells, while ACE-2 expression decreases markedly⁽³⁾. Thus, it can be considered that being adapted to a higher altitude zone decreases the probability of being infected by SARS-CoV-2 and increases the ability to resist the severe symptoms caused by COVID-19.

Lei et al.⁽⁴⁾ reported only 134 cases in the Tibetan plateau region located at 3500 meters above sea level (m.a.s.l.) where there are approximately 9 million inhabitants. From the plateau area, Sichuan City reported that just over 50 % of patients were asymptomatic and less than 10 % had severe medical conditions, from which they recovered, not confirming any deaths⁽⁵⁾.

In the case of South America, the areas of Bolivia where the capital, La Paz, is located between 2400 and 4000 meters above sea level have been studied. Other provinces are also at high altitudes, such as Oruro (3,735 m), Potosí (4,090 m) and Sucre (2,810 m), where a total of 54 cases were detected⁽⁶⁾.

Mortality rate due to COVID-19 in high-altitude cities was also analyzed for Ecuador, Colombia and Chile, where 131.20 and 4 deaths were observed, respectively⁽⁷⁾.

In Peru, it is known that there are regions at sea level and also regions at high altitude, such as Cusco, which is at 3,300 meters above sea level (m.a.s.l.). Up to April 28, 196 cases of the disease had been reported, of which only 3 were transferred to Intensive Care Units (ICUs) and only 4 died, while the entire country had already reported 3,190 cases and 651 deaths⁽⁸⁾. This information suggests that, at higher altitudes, there would be a low rate of infection and less need of making use of ICUs; likewise, there would be fewer deaths.

The relationship between the reported cases of COVID-19 and the zones of altitudes where they occur was analyzed. These zones will be divided into natural Peruvian regions that are coast, highlands and

jungle, which are located at different altitude ranges. Data on COVID-19 cases was obtained from the reports of each Regional Health Management Office of the Ministry of Health of each department in Peru up to April 26, 2020, separating their respective provinces by region (coast, highlands and jungle) (Figure 1).

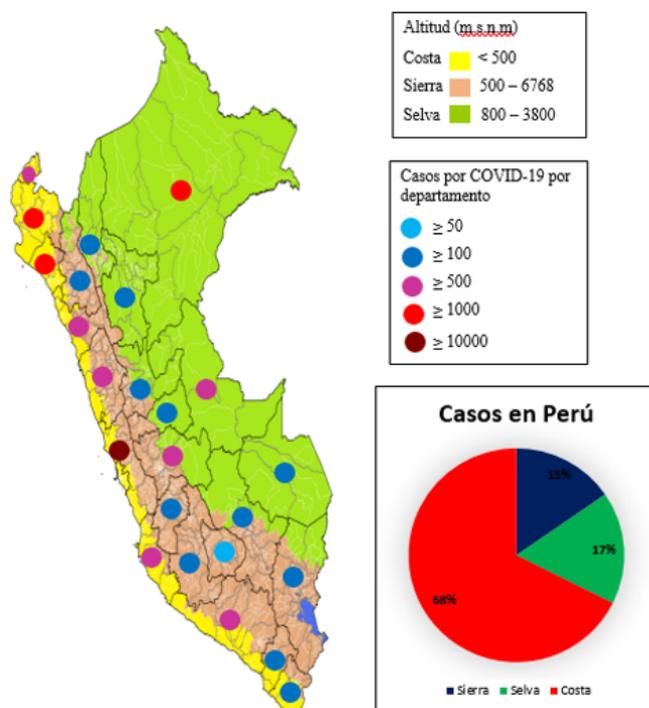


Figure 1. Distribution of cases of COVID-19 patients in Peru by region and altitude up to April 26, 2020

The epidemiological analysis of COVID-19 pandemic indicates a decrease in the prevalence and impact of SARS-CoV-2 infection in populations living at altitudes above 2500 m.a.s.l. Populations were less susceptible to developing serious adverse effects in acute SARS-CoV-2 infection.

The reason for the decrease in the severity of the global high-altitude outbreak of COVID-19 could be related to both environmental and physiological factors, as well as cultural factors; therefore, studies analyzing this association are needed.

CONFLICT OF INTEREST

No conflict of interest is noted

AUTHORS CONTRIBUTION

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