

Letters to the Editor

Feline Infectious Peritonitis and Feline Coronavirus Interest During the COVID-19 Pandemic: A Google Trends Analysis

¹Mohammad Jokar, ²Vahid Rahmanian, ²Nader Sharifi, ²Narges Rahmanian and ³Hekmatollah Khoubfekr

¹DVM, Faculty of Veterinary Medicine, Karaj Branch, Islamic Azad University, Karaj, Iran

²Zoonoses Research Center, Jahrom University of Medical Sciences, Jahrom, Iran

³Iranshahr Health Services, Iranshahr University of Medical Sciences, Iranshahr, Iran

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Corresponding Author:

Vahid Rahmanian

Zoonoses Research Center,

Jahrom University of Medical

Sciences, Jahrom, Iran

Email: rahmanian.vahid@ut.ac.ir

Abstract: Coronaviruses infected different species of animals, such as feline, canine, swine and bovine. In veterinary medicine, a significant fatal coronavirus disease in Felidae is Feline Infectious Peritonitis (FIP). The Internet provided many websites about small animals that present educational content for disease prevention, pets welfare, etc. Upper than 90% of internet users chooses Google as a search engine. In 2008, Google Company launched Google Insights for search that displaying search trends data. Finally, this company merged Google Insights for Search into Google Trends (GT). We conducted a Google Trends analysis to evaluate search interest in FIP and feline coronavirus in the COVID-19 pandemic. For this purpose, we search two topics, "Feline infectious peritonitis" and "Feline coronavirus" in GT, for collecting data. The duration of study was selected in two periods: January-November 2020, the COVID-19 period and the same period in 2019 for comparison. Comparison of the RSV means between these two periods was performed using two independent samples t-test with assuming unequal variances and two-sided p-value <0.05 considered statistically significant. The RSV of "Feline infectious peritonitis" and "Feline coronavirus" topics have significantly increased during the COVID-19 period comparing with the same period in 2019 (p-value <0.05). After the COVID-19 pandemic onset, all aspects of our lives were affected by pandemic consequent problems. This global attention to COVID-19 has made a valuable opportunity for presenting the importance of corona viral diseases in any species. The increase of interest in searching about Feline infectious peritonitis and Feline coronavirus indicated that continued global concerns were raised about this infection in felines. The results of this study can be useful for animal health policymakers, veterinarians and journalists to help reduce concerns about FIP and Feline coronavirus by providing educational content on the Internet.

Keywords: Coronavirus, COVID-19, Outbreak, Google Trends

Dear Editor

In December 2019, a respiratory syndrome with an unknown cause was reported in Wuhan, China. The new coronavirus isolated from patients on 7 January 2020 and named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) (Phelan *et al.*, 2020). The first Coronavirus Disease 19 (COVID-19) fatality in China was declared on January 11, 2020. Rapidly after nine days, various countries reported positive cases and consequent problems were started (Majumder and Mandl, 2020). The

World Health Organization declared COVID-19 as pandemic on 11 March 2020; currently, there have been 59,7 million verified cases and 1,4 million deaths worldwide (WHO, 2020).

The COVID-19 pandemic has revealed the importance of the Coronavirus and its diseases to humans around the world (Mertens *et al.*, 2020). Before this global concern, Coronaviridae claimed many lives from animals, especially cats (Paltrinieri *et al.*, 2020; Pedersen, 2009). However, this increase in awareness may help control coronavirus diseases in animals.

Coronaviruses infected different species of animals, such as feline, canine, swine and bovine (Abdel-Moneim and Abdelwhab, 2020; Decaro and Lorusso, 2020). In veterinary medicine, a significant fatal coronavirus disease in Felidae is Feline Infectious Peritonitis (FIP) (Pedersen, 2009). Feline Infectious Peritonitis Virus (FIPV), the FIP agent, affected several organs, such as the lungs, spleen, liver, kidneys, serosae, central nervous system and eyes. Two main clinical presentations have been seen in FIP, the wet and the dry form. The wet form, protein-rich fibrinous fluids accumulation in body cavities causes hypovolemia and organ compression (e.g., dyspnea, peristalsis problems, etc.). However, in the dry form, FIPV causes granulomatous lesions in affected organs (Paltrinieri *et al.*, 2020; Pedersen, 2014).

The Internet provided many websites about small animals that present educational content for disease prevention, pets welfare, etc. (Wahl, 2017). User activities on the internet, especially in health, became attractive topics for researchers (Eysenbach, 2011; Infodemiology, 2011; Jahanbin and Rahmanian, 2020; Jahanbin *et al.*, 2021). One of the important subjects for researchers is the level of interest in searching for something among users (McDaid and Park, 2010; Schootman *et al.*, 2015).

Upper than 90% of internet users chooses Google as a search engine (StatCounter.com, 2019). In 2008, Google Company launched Google Insights for search that displaying search trends data. Finally, this company merged Google Insights for Search into Google Trends (GT) (Matias, 2012). GT is a website that analyzes and visualizes search queries' relative interest in different regions and languages. In this tool, search popularity has been shown by the Relative Search Volume (RSV) index, which has a 0 (absence of interest) to 100 (highest interest) range (Mavragani *et al.*, 2018). The advantages of Google trend analysis in medical research are predicted and surveillance of high prevalent diseases and epidemics. It has been used extensively to the identified outbreaks of infectious diseases (Jahanbin and Rahmanian, 2020). Google Flu Trends collects google search data from 2008 to 2015 in more than 25 countries to forecast flu epidemics (Yang *et al.*, 2015). The implication was that large numbers of Google search queries could be examined to reveal if there was a flu-like illness exists in an area.

We conducted a Google Trends analysis to evaluate search interest in FIP and feline coronavirus in the

COVID-19 pandemic. For this purpose, we search two topics, "Feline infectious peritonitis" and "Feline coronavirus" in GT, for collecting data. The benefit of topic search in GT is including RSV of universal queries related to the topic without limitation in a specific language (Google, 2015). The duration of study was selected in two periods: January-December 2020, the COVID-19 period and the same period in 2019 for comparison. Comparison of the RSV means between these two periods was performed using two independent samples t-test with assuming unequal variances and two-sided p-value <0.05 considered statistically significant. We used trial version of StatDirect statistical software (<http://statdirects.com>) for analysis.

Comparisons of the means of RSV and percentage change for related search topics are detailed in Table 1. The RSV of "Feline infectious peritonitis" and "Feline coronavirus" topics have significantly increased during the COVID-19 period (comparing with the same period in 2019 (p-value <0.05). The mean of monthly RSV of two topics during the two investigated period has been presented in Fig. 1. Our investigation in GT is limited by lack of demographics information and data from other search engines.

After the COVID-19 pandemic onset, all aspects of our lives were affected by pandemic consequent problems. This global attention to COVID-19 has made a valuable opportunity for presenting the importance of corona viral diseases in any species. The increase of interest in searching about Feline infectious peritonitis and Feline coronavirus indicated that continued global concerns were raised about this infection in felines. The results of this study can be useful for animal health policymakers, veterinarians and journalists to help reduce concerns about FIP and Feline coronavirus by providing educational content on the Internet. This study is unique in veterinary medicine. However, in medicine and public health, many studies have been conducted to evaluate the interests of searching in the field of health or disease during the COVID-19 pandemic; for example, surveying the google search interest for Facial Plastic Surgery, smoking cessation and Kawasaki disease during the COVID-19 pandemic period (Dey and Zhao, 2020; Duggan *et al.*, 2020; Heerfordt and Heerfordt, 2020).

The limitation of this investigation are that search interest data are limited to Google users and google trend does not report search results with an exact number but reports relatively.

Table 1: Relative search volume during the COVID-19 period vs previous year

Search topic	RSV, 2020, mean (SD)	RSV, 2019, mean (SD)	Percent change	Difference in means	95% CI	p-value
Feline infectious peritonitis	64.76 (4.65)	52.47 (14.58)	23.40	12.28	[7.88, 16.68]	<0.001 ^b
Feline coronavirus	19.69 (23.11)	1.84 (0.55)	965.88	17.84	[10.96, 24.72]	<0.001 ^b

^bTwo-sided p-value <0.05, statistically significant. RSV, Relative Search Volume. SD, Standard Deviation. CI, Confidence Interval

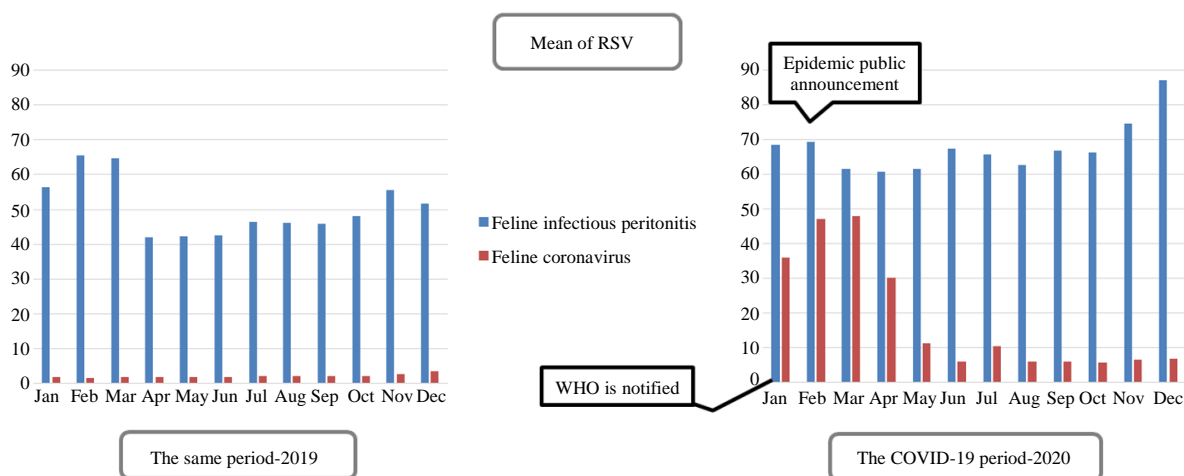


Fig. 1: (a) Popularity in Google searches for “Feline infectious peritonitis” and "Feline coronavirus", January-December 2020 (the COVID-19 period) and the same period in 2019. RSV scores ranged from 0 (lack of interest) to 100 (highest interest) and presented monthly.

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Authors' Contributions

Mohammad Jokar: Organized the study, proposal of study writing, data gathering, manuscript preparation, data analysis and interpretation of data, literature search and final revision of the study.

Vahid Rahmanian: Organized the study, proposal of study writing, analysis and interpretation of data, manuscript editing, final revision of the study content and final approval of the revision the manuscript.

Nader Sharifi, Narges Rahmanian and Hekmatollah Khoubfekr: Data gathering, Design of study, literature search and final approval of the version of the manuscript.

Ethics

The authors of this study followed the ethical principles, including guidance on authorship, avoiding redundant (duplicate) publication, avoiding plagiarism, transparency, ensuring accuracy that potential complications.

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