

## **Epidemiological profile of feline viral immunodeficiency (FIV) in cats seen at veterinary clinics in Manaus, Amazonas (2020-2021)**

### **Perfil epidemiológico de la inmunodeficiencia viral felina (IVF) en gatos atendidos en clínicas veterinarias de Manaus, Amazonas (2020-2021)**

DOI: 10.53499/sfjeasv2n4-002

Received in: Aug 5rd, 2022

Accepted in: Sep 30th, 2022

#### **Alia Sabrina Souza Batista**

Undergraduate in Veterinary Medicine

Institution: Federal Institute of Education, Science and Technology of the State of Amazonas (IFAM), Campus Manaus Zona Leste (CMZL)

Address: Avenida Cosme Ferreira, nº 8.045, Bairro: São José Operário, Manaus/AM

E-mail: aliasabrina4@gmail.com

#### **Ludmila Andrade Estevam**

Veterinarian Post-graduated in Feline Medical and Surgical Clinic by the Qualittas Institute

Address: Rua Altair Severiano Nunes, nº 73, Bairro: Parque 10, Manaus/AM

E-mail: ludmilaandrademedfel@gmail.com

#### **Edson Francisco do Espírito Santo**

PhD in Animal Science from the Universidade Estadual Paulista "Júlio de Mesquita Filho

Institution: Federal Institute of Education, Science and Technology of the State of Amazonas (IFAM), Campus Manaus Zona Leste (CMZL)

Address: Avenida Cosme Ferreira, nº 8.045, Bairro: São José Operário, Manaus/AM

E-mail: edson.santo@ifam.edu.br

### **ABSTRACT**

Feline viral immunodeficiency is one of the main causes of morbidity and mortality in this animal group. Considering the increase in the population of cats in Manaus, it is necessary to know the parameters that can relate the species to this disease. This research aimed to carry out a study on the epidemiological profile of feline viral immunodeficiency in cats that were treated at veterinary establishments in the city. The period of analysis was from 2020 to 2021, with the collection of data from medical records of patients from veterinary clinics, registered in CRMV-AM, located in six zones of the city. The parameters evaluated were: region of greatest occurrence in the municipality, seasonality, breed, sex, age, weight, frequency of death, management, and main clinical signs presented. 1413 clinical files were analyzed, but only in 420 cases tests for the disease were requested, 81 with positive results. Cases of the disease were detected in all areas of the municipality, with a higher prevalence in cats of mixed breed (98.77%), males (65.43%), aged  $\geq 1$  year (80.25%), weighing on average 2 kg (88.89%) and castrated (43.14%). Based on the results, it can be stated that the feline viral immunodeficiency agent is widespread throughout the city of Manaus, and it is expected that this research

will contribute to the knowledge of Veterinary Doctors, in the early diagnosis of the disease, as well as the guidance of measures prophylactic measures in order to minimize the spread of the disease in the feline species.

**Keywords:** small animal clinic, feline, epidemiological survey, retrovirus, Manaus zones.

## RESUMEN

La inmunodeficiencia vírica felina es una de las principales causas de morbilidad y mortalidad en este grupo animal. Considerando el aumento de la población de gatos en Manaus, es necesario conocer los parámetros que pueden relacionar la especie con esta enfermedad. El objetivo de esta investigación era realizar un estudio sobre el perfil epidemiológico de la inmunodeficiencia vírica felina en gatos atendidos en establecimientos veterinarios de la ciudad. El período de análisis fue de 2020 a 2021, con la recopilación de datos de historias clínicas de pacientes de clínicas veterinarias, registradas en CRMV-AM, ubicadas en seis áreas de la ciudad. Los parámetros evaluados fueron: región de mayor ocurrencia en la ciudad, estacionalidad, raza, sexo, edad, peso, frecuencia de muerte, manejo y principales signos clínicos presentados. Se analizaron 1.413 historias clínicas, pero sólo en 420 casos se solicitaron pruebas para detectar la enfermedad, 81 de las cuales resultaron positivas. Se detectaron casos de la enfermedad en todas las zonas de la ciudad, con mayor prevalencia en gatos sin raza definida (98,77%), machos (65,43%), de edad  $\geq 1$  año (80,25%), con un peso medio de 2 kg (88,89%) y esterilizados (43,14%). Con base en los resultados, se puede afirmar que el agente del VIF está diseminado en la ciudad de Manaus, y se espera que esta investigación contribuya al conocimiento de los profesionales veterinarios en el diagnóstico precoz de la enfermedad, así como a la orientación de medidas profilácticas para minimizar la diseminación de la enfermedad en la especie felina.

**Palabras clave:** clínica de pequeños animales, felino, levantamiento epidemiológico, retrovirus, zonas de Manaus.

## 1 INTRODUCTION

Viral infections in cats are common, and most of these etiologic agents are quite contagious, spreading from one animal to another. Many viruses cause lifelong infectious processes, and affected individuals are important sources of infection where animal density is high (GONÇALVES; VOLKWEIS, 2019).

Feline immunodeficiency virus (FIV) is an important agent that can affect domestic felines and is characterized by a great capacity for infection among individuals of this species, thus becoming one of the main infections of today. FIV is part of the Retroviridae family and can affect domestic and wild cats. It is diploid of monofilament RNA, with a cone-shaped capsid made of the central protein; it also has a lipidic envelope in which glycoproteins are present, responsible for allowing the entry and fixation in the host cell. It has a high mutation rate and, even within a host, the population is

heterologous, with one individual differing slightly from another. In this way, each animal is infected by a group of variants, not just a single genotype (LITTLE, 2016). FIV causes an acquired immunodeficiency syndrome, increasing the risk of opportunistic infections, neurological diseases and neoplasms (GUIMARÃES, 2022).

In general, the infection by this retrovirus may be directly related to the cats' lifestyle, age and sex (GONÇALVES; VOLKWEIS, 2019). Regarding FIV, its main mode of transmission is through lesions caused by bites, which promote the introduction of saliva containing the virus and infected white blood cells, situations that occur naturally in fights (LITTLE et al., 2020). Studies state that adult, non-castrated male cats, with access to the street, have greater chances of contracting the disease, considering their aggressive behavior in disputes for females and territories (TEIXEIRA et al., 2007; TEIXEIRA et al., 2019).

Normally, retrovirus infections have classifications that can have a direct influence on the immune response and the aggressiveness of the disease. FIV primarily targets CD4<sup>+</sup> T lymphocytes, which act directly in identifying and destroying viruses, bacteria, and fungi, and are responsible for aiding in immunity, hormonal response, producing antibodies, and cellular response, producing and releasing cytokines and interleukins. The virus binds to the CD4<sup>+</sup> proteins that are normally on the surfaces of lymphocytes and thus can enter the cell to make its replication (BOTELHO, 2014).

The virus has different genetic forms, which are divided into viral subtypes, and there is a relationship between the differences in subtypes and their geographic distribution. Currently, five subtypes are considered, including A, B, C, D, E. Among these, the most common are A and B (GUIMARÃES, 2022). It was also identified that its phases are identical to those observed in human HIV. Initially there is the acute phase, a situation in which a viremia peak develops and the individual's body creates an immune response against the virus. This process occurs around the third and sixth weeks after infection, where there is a generalized stimulation of T and B cells in the germinal centers and is marked by specific symptoms such as fever, anorexia, lethargy, weight loss, transient lymphadenomegaly, and leukopenia. After this period, the host will be asymptomatic, in which case it will show no signs of disease and appear healthy. With the return of a large viral load, the beginning of the terminal phase develops, where the feline acquired immunodeficiency syndrome will be considered (LORENZETTI, 2021). This may last months or years, and this period will depend on the age of the animal,

exposure to secondary diseases or even if the animal is using immunosuppressants (LACERDA, 2015).

The diagnosis of this disease should be based on a combination of clinical and laboratory tests. Two rapid tests are available in Brazil for the diagnosis of this disease: a bidirectional flow immunochromatography kit (SNAP® Combo IDEXX) and a unidirectional lateral flow immunochromatography kit (ALERE/BIONOTE Anigen Rapid) (MEDEIROS et al., 2019). Currently, tests used in one's own outpatient/consulting room, commonly referred to as "rapid tests," have been instrumental in diagnosing retroviral infections such as FIV (LORENZETTI, 2021).

The depletion of the immune system is the main cause of the high mortality and morbidity of FIV seropositive cats. When it comes to the incidence and prevalence of the disease, these can vary according to region, sex, age, seasonality, and how these individuals live and behave in societies. Epidemiological research related to this disease is of great importance for the implementation of control and prevention measures, since the virus leads to nonspecific clinical signs and is highly contagious (ROCHA et al., 2019).

Considering the high population rate of stray and semi-domesticated felines in the areas of the municipality of Manaus, it should be noted that such factors are predisposing to the spread of the disease in other regions, according to studies conducted by Botelho (2014) and Paula et al. (2014). Thus, the aim of this study was to perform a survey of FIV casuistry in cats treated in veterinary facilities in the city of Manaus-AM, and thus identify factors such as: region of higher occurrence, seasonality, breed prevalence, sex, age, weight, frequency of death, management, and main clinical signs presented.

## **2 MATERIAL AND METHODS**

During the development of the information survey, we used the system of individual research in the database of veterinary clinics where we collected retrospective materials by consulting electronic and physical records of feline patients who were treated in the aforementioned establishments. These were selected according to their relevance to the care of cats in the city, and according to the legal registration with the Regional Council of Veterinary Medicine of the State of Amazonas (CRMV - AM), considering that the participation of establishments was consented to by their managers and kept confidential. The research included ten clinics located in different areas of the city of Manaus, which are: North, East, South, West, Center-South and Center-West.

The study population was selected for the cats that tested positive for FIV, and the clinical records were consulted and quantified in the period from January 2020 to December 2021, totaling 430 tests requested for the disease in 24 months of evaluation. Data related to the region, year and month of occurrence, race, sex, age, weight, main clinical signs, frequency of death, secondary diseases, and management of the disease were collected, seeking to conduct a survey of the predisposing factors of the infectious disease under study.

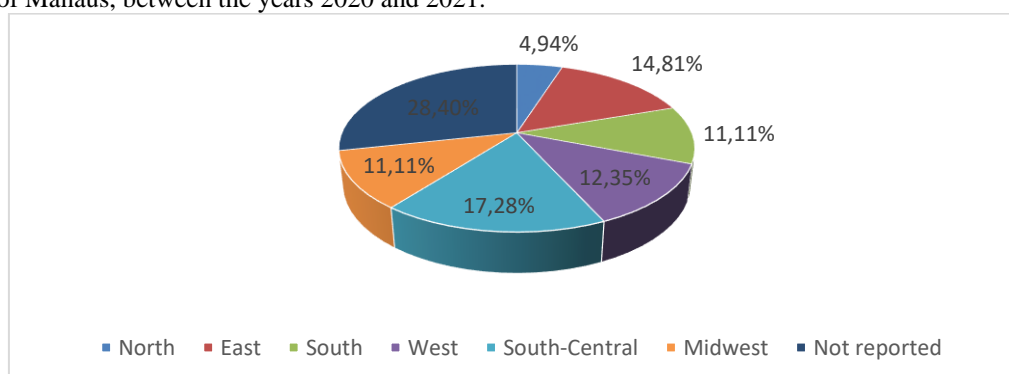
Subsequently, the data were analyzed and processed to perform a descriptive statistical survey, considering the sample of patients who were diagnosed with the disease. From this, it was sought to associate predisposing factors, frequencies, distribution and deaths, obtaining mean, standard deviation, and minimum and maximum values.

### 3 RESULTS AND DISCUSSION

In total, ten veterinary clinics were visited for data collection, which were selected in order to contemplate all areas of the city of Manaus, which are: North, East, South, West, South-Center and West-Center. From January 2020 to December 2021, 1413 medical records were evaluated, and of these, the population submitted to diagnostic tests and with positive results for FIV was selected. Tests were performed in 430 animals, and of these, 81 resulted in positivity for feline viral immunodeficiency.

As for the relative frequencies of the regions in the city of Manaus, we found that the Center-South zone presented the highest casuistic (17.28%) of feline immunodeficiency, according to Chart 1. The Center-South area has a higher number of semi-wild and stray animals, besides having reference establishments for feline care, which intensifies the testing.

Graph 1 - Number of cases, in percentage, positive for FIV according to the distribution of the zones of the city of Manaus, between the years 2020 and 2021.

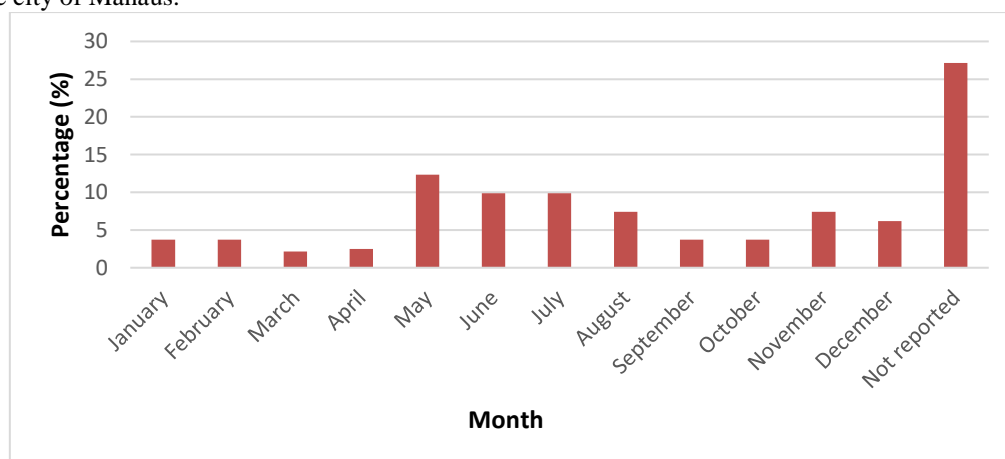


In relation to the year and month of research, the year 2021 and the month of May had the highest prevalence in the number of cases, 12.35% and 60.49%, respectively. Table 1 shows the number of positive cases according to the year, and Chart 2 illustrates the distribution of cases according to the months.

Table 1- Occurrence of FIV in cats seen and tested in veterinary clinics in the city of Manaus, in the years 2020 and 2021.

Year	Number of Positive Animals	Percent (%)
2020	32	39,51
2021	49	60,49
<b>Total</b>	<b>81</b>	<b>100</b>

Graph 2 - Distribution of positive cases for FIV according to months, in the period from 2020 to 2021, in the city of Manaus.



Gonçalves (2014) cites in his work, the low prevalence of FIV in the city of Manaus in 2014. However, due to the percentages presented in this research, it can be considered a change in this scenario today, considering that the disease is constantly evolving and spreading in the species. It is important to note that there are no records in the literature regarding specific periods of incidence of the disease and seasonality.

Regarding species and breed factors, non-defined breed (SRD) cats were more affected in the study period, representing 98.77% of cases. The first justification for this result is due to the fact that the city of Manaus has a low number of cats with defined breeds. Additionally, other studies show that these results suggest that the origin of the animals (in this case, animals that were strays and were adopted, most often SRD, and animals that have always had free access to the street), may be an important factor for the transmission of FIV and are routine cases (BOTELHO, 2014; GUIMARÃES, 2022).

Based on sex, higher casuistry was seen in males (65.43%) compared to females (34.57%). Guimarães (2022), when performing analysis of medical records and FIV testing at the university hospital of UEMA in the period from 2019 to 2021, identified that higher rates of infection are found in adult male cats with free access to the streets, which often show aggressive behavior. Such behavior characterizes the main form of virus transmission, which is by direct contact, through saliva and through bites and injuries during fights, which occur mainly for territory defense or in the reproductive period (HARTMANN, 2015).

Regarding the reproductive status, most individuals were neutered (43.14%), which is in line with studies by Botelho (2014) and Biezu (2017), since these authors state that seropositivity is higher in adult whole, stray, feral cats that have the characteristics of being male, aggressive and with access to the outside, which have direct or indirect contact with other cats or virulent products.

As for the frequency of cases in different age groups, the range included cats diagnosed from 1 month to 16 years, with a mean of 4.54 years and standard deviation of 3.97 years. The highest occurrence of the disease was identified in cats aged 1 to 2 years, results that are similar to the study by Santos et al. (2022), at the Universidade Federal Rural da Amazônia, in which blood samples from asymptomatic cats were analyzed through the polymerase chain reaction technique to detect FIV. These data are also reflective of the pathogenesis and transmission routes of the virus, because according to Biezu (2017), FIV infection of felines happens horizontally or vertically. Horizontal infection occurs through mucosal (oronasal and vaginal) exposure to the virus, as well as by parenteral inoculation of viral particles present in the saliva or blood of an infected animal. The vertical form, which is more common in the experimental setting, occurs by transmission of the virus from mother to offspring, either prenatally or postnatally. In other words, feline behaviors in the early stages of life corroborate the aforementioned ideas and predispose them to infections, such as licking and even breastfeeding, besides the possibility of being born with the virus, transmitted by the mother transplacentally. However, in both cases there is a great possibility of an early diagnosis in relation to the age group, but there are still chances, depending on the method used, of having false-positive results (HOSIE, 2009).

The weight parameter ranged from 800 g to 7.1 kg, with means and standard deviations of 3.56 kg and 1.42 kg, respectively. However, the casuistic was more prevalent in individuals weighing 2 kg or more (88.89%), a fact that is directly aligned



with the age of the animals, since it is the natural weight for cats aged 1 to 2 years. No studies confirming the influence of the weight factor in relation to the pre-disposition of felines to FIV have been identified in the literature.

As for the clinical signs presented by the animals, the most constant ones were anemia, lethargy, progressive weight loss, respiratory tract diseases, immunodepression and lymphadenopathy. These results are similar to those of Simino (2022), who, when performing a retrospective descriptive study of records of cats, seen between 2018 and 2021 in a veterinary hospital in the Federal District region, identified very similar signs, as well as the main hematological alterations of leukocytosis, thrombocytopenia and anemia.

In this context, Silva (2007) determines that feline viral immunodeficiency can be characterized in five stages, based on the clinical signs presented, as follows: 1) acute phase: where the patient may or may not present clinical signs, and in case of presentation, the picture is characterized by fever, lymphadenopathy, depression, diarrhea and appearance of upper respiratory tract infections; 2) phase of the asymptomatic carrier in which the animal does not present any type of symptom and this may last for years; 3) phase of generalized lymphadenopathy: which consists of a generalized increase in lymph nodes, and may also present non-specific signs such as fever, weight loss, or behavioral alterations; 4) phase of ARC (AIDS related complex): moment when chronic and secondary infections to the syndrome prevail; 5) FAIDS (feline AIDS) phase: phase in which there is continuity of chronic and severe opportunistic infections, in addition to the appearance of tumors and edematization. In relation to the present research, the death rates were low, only 3.70%, and most of the time these animals were already diagnosed in the last two phases mentioned above.

#### **4 FINAL CONSIDERATIONS**

With this study it is possible to consider that in the city of Manaus there is a great dissemination of FIV. This reality occurs mainly because of the number of stray cats and the lifestyle of semi-homeless cats, causing the transmission of the disease through direct contact between infected and healthy animals.

Non-bred cats were the most affected, since the number of bred cats in the city is still low. Regarding sex, male cats had the highest incidence, following the same path of research in other states that indicate that males are more prone to contract the disease due to their history of fights over territory and sexual activity. When it comes to age, cats aged



six months to two years were highlighted, since in comparison to other studies, adult animals from five years and older are indicated as the most diagnosed, concluding that in the region of Manaus the tests are being done earlier.

Because it is a disease with a high rate of transmission and difficult to control throughout Brazil, and it is no different in the target city of this study, it is necessary the cooperation between veterinarians and guardians for tests to be requested and routinely performed in the feline medical clinic, in addition to the adoption of prophylactic measures in order to reduce as much as possible the stay of felines on the streets, especially those semi-domesticated.

Considering that feline viral immunodeficiency can trigger several clinical signs, besides being masked by secondary diseases, it is of utmost importance that an assertive diagnosis be made. This can only be considered through testing for the disease, so that the patient can receive the correct care, have a favorable survival and not transmit the disease to other animals.

#### **ACKNOWLEDGMENTS**

I would like to thank the Amazonas State Research Support Foundation (FAPEAM) for making this research possible through financial support, all the participating veterinary clinics for making it possible to consult patient data, my advisors for dedicating their time and contributing to my learning, and everyone involved before, during, and after the study.

## REFERENCES

- Biezus, G. (2017). *Infecção pelos vírus da leucemia (FELV) e imunodeficiência (FIV) em gatos do planalto de Santa Catarina: prevalência, fatores associados, alterações clínicas e hematológicas*. 2017. 91f. Dissertation (Graduate Program in Animal Science, AgroVeterinary Sciences Center) - Universidade do Estado de Santa Catarina, Lages, 2017.
- Botelho, S. M. A. (2014). *Estudo epidemiológico do vírus da imunodeficiência felina e do vírus da leucemia felina em gatos errantes e assilvestrados da Ilha de São Miguel, Açores*. 2014. 124f. Dissertation (Integrated Master in Veterinary Medicine) - Universidade de Lisboa, 2014.
- Gonçalves, C. C. (2014). *Pesquisa de anticorpos IgG do vírus da imunodeficiência felina em gatos domésticos na cidade de Manaus, Amazonas, durante o mês de maio de 2014*. 28f. Course Conclusion Work (Bachelor of Veterinary Medicine) - Escola Superior Batista do Amazonas - ESBAM, Manaus, 2014.
- Gonçalves, R. J., Volkweis, F. S. (2019). *Vírus da imunodeficiência felina e vírus da leucemia felina*. 2019. 22f. Course Conclusion Work (Bachelor of Veterinary Medicine) – Centro Universitário do Planalto Central Aparecido dos Santos - UNICEPLAC, Gama, 2019.
- Guimarães, N. L. S. (2022). *Frequência de diagnóstico de FIV (imunodeficiência viral felina) e FELV (leucemia viral felina) em gatos atendidos no Hospital veterinário da UEMA no período de 2019 a 2021*. 2022. 45f. Course Conclusion Work (Bachelor of Veterinary Medicine) - Universidade Estadual do Maranhão (UEMA), São Luís, 2022.
- Hartmann, K. (2015). *Infecção pelo vírus da Leucemia Felina*. 4. ed. Rio de Janeiro: Guanabara Koogan LTDA.
- Hosie, M. J. (2009). Feline Immunodeficiency ABCD guidelines on prevention and management. *Journal of Feline Medicine and surgery*, 11 (7), 575-584.
- Lacerda, L. C. (2015). *Frequência do vírus da imunodeficiência felina e leucemia felina, fatores associados, achados hematológicos, bioquímicos, e coinfeções com Toxoplasma gondii na microrregião de Ilhéus – Itabuna Bahia*. 2015. 72f. Dissertation (Master in Animal Clinic and Health) - Universidade Estadual de Santa Cruz, Ilhéus, 2015.
- Little, S. E. (2016). *O gato: medicina interna*. 1.ed. Rio de Janeiro: Roca.
- Little, S. E., Levy, J., Hartmann, K., Lehmann, R. H., Hosie, M., Olah, G., Denis, K. T. (2020). AAFP Feline Retrovirus Testing and Management Guidelines. *Journal of Feline Medicine and Surgery*, 22 (7), 5-30.
- Lorenzetti, D. M. (2021). *Aspectos epidemiológicos e doenças associadas à infecção retroviral em gatos submetidos à necropsia*. 2021. 43f. Dissertation (Post-Graduation in Veterinary Medicine) - Universidade Federal de Santa Maria, Centro de Ciências Rurais, Rio Grande do Sul, 2021.

- Medeiros, S. O., Silva, B. J. A., Carneiro, A. L., Ferreira Junior, O. C., Tanuril, A. (2019). Avaliação de dois testes sorológicos comerciais para diagnóstico das infecções pelo FIV e pelo FELV. *Arquivo Brasileiro de Medicina Veterinária e Zootecnia*, 71 (2), 447-454.
- Paula, E. M. N., Cruz, C. A., Moraes, C., Sousa, D. B., Bartoli, R. B. M. (2014). Características epidemiológicas da Leucemia Viral Felina. *PUBVET*, 8 (16), 1-27.
- Rocha, A. M., Filho, P. S., Sampaio, K. O., Cunha, M. G. M. C. M. (2019). Soroprevalence of feline immunodeficiency vírus and feline leukemia vírus in domestic cat of Fortaleza, Ceará. *Brazilian Journal of Veterinary research and animal*, 56 (1), 1-7.
- Santos, C. C., Valente, K. F., Souza, C. C. N., Barrozo, P. H. M., Brito, J. S., Santos, S. B., Neta, A. A. M. S., Martins, F. M. S., Cruz, A. V., Casseb, A. R. (2022). Detecção do vírus da imunodeficiência felina em gatos domésticos (*Felis Catus*) pela técnica de reação em cadeia da polimerase. *Revista Brasileira de Ciência Veterinária*, 29 (1), 46-49.
- Silva, F. R. C. (2007). *Prevalência das infecções pelo vírus da leucemia viral felina e da imunodeficiência viral felina na cidade de Porto Alegre*. 2007. 57f. Dissertation (Master in Veterinary Sciences) - Universidade Federal do Rio Grande do Sul, Porto Alegre, 2007.
- Simino, B. M. (2022). *Ocorrência de retrovíroses em felinos, no período de 2018 a 2021 em um hospital veterinário do Distrito Federal*. 2022. 26f. Course completion work (Bachelor of Veterinary Medicine) - Centro Universitário do Planalto Central Aparecido dos Santos – Uniceplac, Gama, 2022.
- Teixeira, B. M., Junior, A. R., Hagiwara, M. K. (2019). Vírus da imunodeficiência felina – uma atualização. São Paulo. *Biblioteca digital da Produção Intelectual*, 15 (88), 54-66.
- Teixeira, B. M., Rajão, D. S., Leite, R. C., Reis, J. K. (2007). Ocorrência do vírus da imunodeficiência felina e do vírus da leucemia felina em gatos domésticos mantidos em abrigos no município de Belo Horizonte. *Arquivo Brasileiro de Medicina Veterinária e Zootecnia*, 59 (4), 939-942.