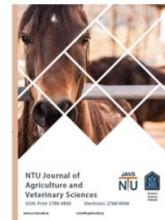




P-ISSN: 2788-9890 E-ISSN: 2788-9904

NTU Journal of Agricultural and Veterinary Sciences

Available online at: <https://journals.ntu.edu.iq/index.php/NTU-JAVS/index>



Serological detection of Feline herpes virus 1 antibodies in cats in Mosul city

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Article Information

Received: 03-04- 2024,

Accepted: 25-07-2024,

Published online: 28-06-2025

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Keywords:

FHV-1,
Cats,
ELISA,
Mosul city.

A B S T R A C T

The study included 200 cats of different ages, genders, types of breeding, source, vaccination programs, as well as the health status. They were examined traditionally and clinically and recorded clinical signs appearing on them, and then blood samples were collected from cephalic vein. It was later transferred as soon as possible to the Microbiology Laboratory to the purpose of investigating specific antibodies the feline herpes virus in the blood collected from cats, an indirect ELISA test was used. The results of the clinical examination in the animals that were examined during the study showed the presence of clinical signs of varying intensity and type, as represented by the presence of secretions from the eyes with conjunctivitis, nasal secretions, abortion in pregnant females, ulcers of different sizes in the tongue and gums, in addition to that some animals were apparently healthy. The results of the serological study showed the presence of a number of positive samples of feline herpes virus of 118 cats out of a total of 200. The highest positive percentage was in the ages less than six months. In cats that suffer from ulcers in the mouth and in cats that are indoors management, in addition to the presence of a high percentage of positive samples with feline herpesvirus in imported cats compared to local ones. It was also found through the serological study using the indirect ELISA test and the presence of the highest number of positive samples in the vaccinated cats.



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How to cite: Khudhur, W. I., Nomi, B. S., & Albaroodi, S. Y. (2025). Serological detection of Feline herpes virus 1 antibodies in cats in Mosul city. *NTU Journal of Agriculture and Veterinary Science*, 5(2).

Introduction

Feline herpesvirus belongs to the family Herpesviridae within the genus Varicellovirus. This family includes four genera: Iitovirus, Mardivirus, Simplevirus and Varicellovirus. Simple virus infects humans and causes skin infections, while the Iitovirus genus infects rare birds with Pacheco's disease and mucous papilloma, while the Mardivirus genus causes Mareks diseases in poultry. The genus Varicellovirus includes the feline herpes virus, which causes upper respiratory diseases in cats. The genus name Varicellovirus is derived from varicella (chickenpox), which infects children in the form of skin lesions during infection with the virus [1]. The virus is transmitted in several ways, including direct contact with infected cats or indirectly through contaminated tools. The virus has been found to be relatively poorly tolerated in the external environment, and it has been proven that it remains for 18 hours in humid environmental conditions and less in dry conditions [2]. Feline herpesvirus is considered a common and important pathogen in cats, as it causes severe oral infections and upper respiratory tract infections (URTD) [3], where symptoms include a runny nose, sneezing, inflammation of the conjunctiva, as well as abortion [4]. The virus is diagnosed by polymerase chain reaction (PCR) and viral isolation [5], as well as serological tests such as ELISA and immunofluorescence testing to detect the virus and its antibodies [6]. The disease has been recorded in many countries of the world, including in the United States of America, China, and Australia, and the virus has been recorded in countries neighboring Iraq, such as Iran [7]. Due to the lack of studies on this virus in cats and the extent of its impact and spread in Iraq in general, this study was conducted.

Materials and methods

Animals

The study included 200 cats of various ages, genders and nature of breeding, source, and not exposed to any vaccination program in addition to their health status. These cats were followed up through the Veterinary Teaching Hospital - College of Veterinary Medicine - University of Mosul, as well as five veterinary clinics specializing in pets and within the city Mosul, and was examined clinically and using traditional methods, and the clinical signs appearing on it were recorded.

Samples

200 serum samples were obtained by collecting blood from a cephalic vein at a rate of 0.5-1 milliliter. The samples were placed in test tubes and left at room temperature for 15 minutes until the blood coagulated, and then placed in a centrifuge at 1500 rpm for 10 minutes. Separate the serum from the clot, then place the serum in Eppendorf tubes and store it at -20°C until serological tests are performed on it [8].

Enzyme Linked Immunosorbent Assay This test was performed according to the manufacturer's instructions manual DRG® Feline Herpes Virus Ab ELISA (EIA-2472).

Results

The results of the clinical examination in the animals included in the study showed the presence of clinical signs of varying severity and type, as represented by the presence of eye discharge, conjunctival congestion and nasal discharge, abortion in some pregnant females, jaundice, and the presence of ulcers of different sizes on the tongue, gums and on the nose, in addition to is some animals were apparently healthy without showing any clinical symptoms. The results of the serological study using the enzyme-linked immunoassay test showed that there were 118 samples positive for the feline herpes virus out of a total of 200 samples. When comparing the age of the animal to the infection rate, it was found that the highest positive rate was in ages less than six months, and there were significant differences between it and the older age group while no significant differences were recorded with the age group (six months - one year), and this percentage decreased with the advancing age of the animal. Table 1.

Table 1. Relationship of age with the number of positive samples for feline herpesvirus using indirect enzyme-linked immunosorbent assay

Age	No of Animals	No of positive samples	Percentage %
Less than 6 months	87	53	44.9a
6 months-1 year	59	37	31.3a
More than 1 year	54	28	23.7b
Total	200	118	59

The results of the enzyme-linked immunosorbent assay test for the sera of the cats under study showed that the highest positive samples were found in cats suffering from mouth ulcers, while the least positive samples were recorded in cats suffering from jaundice. Table 2.

Table 2. Percentage and frequency of clinical signs of cats infected with feline herpesvirus using indirect immunofluorescence testing

Clinical signs	No of animals	Frequency of clinical signs	Percentage %
Mouth ulcer	45	29	64.4
Nasal discharge	31	14	45.1
Ocular discharge and conjunctivitis	37	11	29.7

Abortion	5	3	60
Jaundice	12	3	25
Healthy	56	22	39.3

The relationship between the management of cat rearing and positive samples for the feline herpes virus, the highest positive samples were found in cats raised indoors when compared to cats raised outdoor, and there were significant differences between them. Table 3.

Table 3. The relationship of positive samples for feline herpes virus to the nature of cat breeding using indirect enzyme-linked immunosorbent assay

Animals' management	No of animals	No of positive samples	Percentage %
In door	143	86	72.9a
Out door	57	32	27.1b

The results also showed that there was a high percentage of positive samples for feline herpes virus in imported cats compared to local ones, and that there were statistically significant differences between them. Table 4.

Table 4. Relationship of feline herpes virus positive samples to feline source using indirect enzyme-linked immunosorbent assay

Source of animals	No of Animals	No of positive samples	Percentage %
Imported	96	63	53.4a
Native	104	55	46.6b

Discussion

Feline herpes virus is one of the main pathogens causing respiratory infections in cats. Disease symptoms vary according to many factors, including the virulence of the strain causing the infection, the immune status of the animal, age, source of the animal, and other environmental and epidemiological factors. The results of the clinical examination of the animals included in the study showed the presence of clinical signs of varying severity and type, as they included the presence of eye discharge with conjunctival congestion, nasal discharge, abortion in some pregnant females, jaundice, and the presence of ulcers of different sizes on the tongue and gums, and these are clinical signs that are characteristic of infection with the herpes virus. feline, but the differences between this study and other studies are in the focus of the clinical signs prevailing in each study, and at the same time, they are similar to the clinical signs of many studies, including: The researchers [9] indicated that the classic clinical signs of infection with feline herpes virus in cats are: conjunctivitis, chronic stomatitis, gingivitis, sneezing, and the presence of lesions in the mouth with mucous secretions from the nose and

eyes. While the researchers stated [10] The presence of highly virulent strains leads to a high mortality rate and causes hemorrhagic lesions throughout the animal's body. While the researcher [11] indicated that the feline herpes virus is ranked second after the feline herpes virus in causing infection of the upper respiratory tract in cats, while the researchers [12] indicated that chronic stomatitis and inflammation The gums are one of the most important signs caused by infection with the feline herpes virus, as well as secondary pathogens that include other viral and bacterial causes, The researcher [13] indicated that chronic stomatitis in cats, caused by the feline herpes virus, is the dominant disease sign, which constitutes a percentage of 95.5% of the total disease signs. At the same time, the aforementioned researcher indicated that the feline herpes virus ranks first. In these infections, the cause of disease is followed by feline herpes virus in a small percentage, the researcher stated [14], who studied in his study 15 cats suspected of being infected with feline herpes virus, found that all of these cats were suffering from mouth ulcers, with 10 of them suffering from loss of appetite. The results of the serological study showed that there was a percentage of positive samples for the feline herpes virus using the enzyme-linked immunoassay test, amounting to 59%. When comparing this percentage with studies conducted in different countries of the world, it became clear that there were differences among them, including: The researchers [3] conducted a survey study over a period of three years on viruses that cause respiratory infection in cats, and it was found that the infection rate using the neutralization test was 14.2% for feline herpes virus. While [15] conducted a survey of respiratory causes in wild cats in Spain, it was found that the infection rate with feline herpes virus reached 80% using enzyme-linked immunoassay, while researchers [16] indicated that the infection rate of feline herpesvirus reached 35% using the neutralization test, and the presence of the virus was confirmed with an infection rate of 16% [17] While a 39.2% infection rate was recorded in Brazil with the feline herpes virus [18], while a high infection rate was recorded in the United States of America, reaching 92.4% [19]. The difference in infection rates is due to many reasons, including the difference in the type of serological test, the specificity of each country regarding the presence of virus strains in the field, the difference in health care that cats receive, as well as the difference in serum dilutions for each test. While some researchers [20] considered the immunofluorescence test gives an inaccurate picture to differentiate between antibodies resulting from immunization from those resulting from infection, and this confirms the presence of a wide spectrum of interaction that this test has with many proteins of the feline herpes virus of various pathogenic and vaccine strains , The results of the serological study showed that there were high rates of positive

samples in cats younger than 6 months, and this percentage decreased as the cats aged. These results varied with many studies, as [21] recorded the highest percentage of positive samples in cats aged 1-3 years. At the same time, he recorded in his study the lowest percentage of positive samples at ages less than one year. The aforementioned researcher explained that young cats receive great attention from their breeders in terms of monitoring their health condition and their vaccination schedule compared to older ages. While there were no researchers [22] revealed any relationship between age and infection with feline herpes virus, while the researchers [23] disagreed with the results of our study, as it was shown by examining the sera of cats in their study using the seroneutralization tests and the enzyme-linked immunoassay. Cats that are more than two years old recorded the highest percentage of positive samples compared to cats that are less than two years old, as they recorded the lowest percentage of positive samples. The researchers explained this for two important reasons: First: the interference of the immunity received from the mother with the initial vaccination against the feline herpes virus. Second: Older cats are more susceptible to infection with the virus as they age. While the researchers [24] indicated that the standard of antibodies specific for the feline herpes virus increases in standard with the advancing age of the animal, while the researchers [25] that the highest standard for the specific antibodies for the feline herpes virus was in the age group less than six months. The results of the enzyme-linked immunosorbent assay showed that there were varying percentages of positive samples for the feline herpes virus when compared to the clinical symptoms appearing in cats, as they were higher in cats suffering from mouth ulcers. These results are consistent with many studies, as [26] However, chronic oral infections are the predominant clinical presentation in infection with feline herpes virus, while [27] indicated that upper respiratory tract infection and conjunctivitis are the most common forms during infection with feline herpes virus, the results varied according to what was stated by [28], who indicated that the most common clinical presentation is It is an infection of the upper respiratory tract. While the results were consistent with what was reported by [29], who indicated that chronic stomatitis is the most common infection as a clinical symptom of feline herpes virus. The discrepancy in results is due to many reasons, the most important of which is the variation in the virulence of the feline herpesvirus strain, as well as the continuous mutations in it, which also result in varying clinical symptoms. As for the relationship between the nature of cat rearing and positive samples for the enzyme-linked immunoassay test, the highest positive samples were found in cats raised indoors when compared to cats raised outside homes, and there were significant differences

between them. These results were consistent with what was mentioned. [30], who indicated in his survey study to investigate the antibodies and antigens of feline herpes virus using enzyme-linked immunoassay and polymerase chain reaction and it was shown from its results that there is no significant difference between the cat breeding system and infection with the feline herpes virus. While the results of the researchers [31] showed that there are high rates of infection in stray cats compared to cats raised indoors, and the explanation for these results is that stray cats are very rarely vaccinated against the feline herpes virus, and this confirms that stray cats are considered a source for infection and the spread of the virus, the other reason was attributed to the role of the nature of home rearing, which is often individual for one animal, which provides an environment that is not crowded with animals, as well as the lack of direct contact with other animals that may be infected or carrying the virus. Another reason was added, which is that stray cats do not have houses that house them, which expose them to many pathogens. The results also showed that there was a high percentage of samples positive for feline herpes virus in imported cats compared to local ones, and that there were statistically significant differences between them. These are consistent with what was stated by [32], who indicated the possibility of imported cats being infected with the disease. It has many viral causes as well as its high sensitivity to infection, while he pointed out [33] indicated that the feline herpes virus could be one of the emergency diseases as a result of transmission through imported animals, while [34] indicated that the transportation of animals and stress factors are considered to be among the most important main factors for infection. With the feline herpes virus, in addition to the possibility of transmitting new strains through the introduction of infected animals, which is considered one of the most dangerous factors.

Acknowledgments.

Acknowledgments should be written in Time New Roman (body), 10pt.

Competing Interests

The authors should declare that there are no competing interests.

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