

Seroprevalence of *Feline Immunodeficiency Virus (FIV)* among Client-owned Cats in Ahvaz, Southwestern of Iran

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Abstract

The present study was conducted to detect prevalence and risk factors for retrovirus infection of infected cats in a cat population in Iran, by evaluation of 238 client-owned cats of different ages that were tested for the presence of FIV antibodies. The cats were selected from those referring to Veterinary Hospital of Ahvaz University, southwestern Iran from December 2007 to June 2010. Classification was made by age, sex, breed, region and season. The studied cats were divided into two age groups (≤ 3 years and >3 years) and based on clinical signs into two groups. Prevalence of FIV antibodies in these cats was 10.5 % by immunochromatography assay, indicating that this virus is present in the environment. The infection had more prevalence in cats above 3 years (13.9 %) compared with cats less than 3 years (4.6 %). Statistical analysis showed significant difference between different age groups. Mean age of FIV-infected and FIV-negative cats were 4.93 ± 0.43 years (range 1.75 – 10 years) and 4.15 ± 0.20 years (range 0.4 – 15 years), respectively. Prevalence of infection was 12.6% in males and 8.1 % in females; nevertheless the infection was not significant between different sexes ($P > 0.05$). Six out of 36 cases (16.7 %) which had clinical signs and 19 out of 202 cases (9.4 %) which did not have clinical signs were seropositive, without significant difference between two groups (95 % CI for OR = 1.92). Risk factors for FIV infection were older age (95 % CI for OR = 3.35), access to outdoor (95 % CI for OR = 140.9) and aggressive behavior (95 % CI for OR = 82.71).

Key words: *Feline Immunodeficiency virus*, Immunochromatography assay, Client-owned cats, Ahvaz, Iran.

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Introduction

Feline immunodeficiency virus (FIV) is a retrovirus of the genus lentivirus that is closely related to *human immunodeficiency virus* (HIV), sharing a similar structure, life cycle and pathogenesis.¹ FIV is an important viral pathogen worldwide in cats and differs from *feline leukemia virus* (FeLV) and *feline foamy virus* (FFV). Five different subtypes have been recognized for FIV (subtypes A, B, C, D, and E).²⁻⁴ In natural settings, FIV is transmitted primarily by parenteral inoculation of virus present in saliva or blood, presumably by bite and fight wounds, accounting for the higher prevalence in male cats.⁵ Clinical signs are generally manifest in middle age cats (4-7 years) that have harbored the virus for an extended period, but cats of any age may contract the disease. These signs may include chronic gingivitis, periodontal disease, chronic anemias and leukopenias, pustular dermatopathies, chronic upper respiratory syndrome and generalized lymphadenopathy.^{4,6} The seroprevalence of FIV is highly variable between regions, with estimates of 1–14 % in cats with no clinical signs and up to 44 % in sick cats.⁷ Since its discovery in 1987 many studies have been conducted worldwide to determine the distribution of FIV.⁸ Reported prevalence differs considerably depending on the geographical region and the cat population evaluated. In Asian surveys the prevalence varies from 0 % to 22 %.^{9,10} In North America, the most recent study reports a prevalence of FIV infection of 2.5 % in client-owned cats¹¹ and between 3.5 % and 23 % in stray cats.^{12,13} Approximately 10 % of cats in Southern Europe are infected with FIV.^{14,15} Whereas Northern European studies report prevalences of 2–6 %.^{7,16} A large number of different approaches have been taken in attempts to create FIV vaccines.¹⁷ Rapid diagnosis of FIV infection is especially important in order to isolate infected cats and prevent secondary

infections of susceptible animals. In Iran, large numbers of cats are found roaming residential streets. They can be an important potential source of transition of infection to other animals. Several laboratory methods have been developed to detect antigen or antibody in the serum of infected cats such as PCR, ELISA, LAT (latex agglutination test), IHA (Indirect hemagglutination assay), VN (Virus neutralization) and IFAT (Indirect Fluorescent Antibody Test). Though these tests are more sensitive, specific and more reproducible, but they can be expensive and generally take time to be analyzed by a specialized laboratory. Immunochromatography assay (ICA)⁷ is one of the most common rapid field diagnostic methods used in clinical practice. Specificity and sensitivity for kits of FIV Ab Test (Biotech Co., Ltd, Shanghai) were found to be above 95 percent according to the manufacture. The aim of this study was first to investigate the antibody detection of FIV in the serum samples of client-owned cats in Ahvaz area, southwestern Iran. Secondly, risk factors were evaluated for FIV infection. This survey provides preliminary information regarding FIV endemic to the Ahvaz region.

Materials and Methods

Sample collection and preparation.

Blood samples were randomly collected of 238 companion cats from December 2007 to June 2010, in Ahvaz area, the capital of Khuzestan province in southwestern Iran. The samples were collected from jugular veins and allowed to clot and centrifuged for 5 min at 1800× g. Serum was removed and stored at –20°C until assayed. The studied cats were divided into two age groups (≤ 3 years and > 3 years) and based on clinical signs (such as lymphadenopathy, periodontal diseases, gingivitis, abscess and cachexia) into two groups. Investigated parameters included putative risk factors including age, gender

and breed. All cats were grouped with regard to housing conditions (only indoors or outdoors; single or multi-cat household; contact or no contact with other cats) and with regard to fighting behavior (fighting or not fighting). One hundred and twenty seven male and 111 female cats were studied. Two ml blood was collected from jugular vein of cats to determine CBC. Ketamine (10 mg kg^{-1}) and acepromazine (0.15 mg kg^{-1}) were injected for sedative effects. The age of the cats ranged between 0.4 to 15 years. Age was estimated by dental formulary and owner information's. Owners were asked to fill out a questionnaire for further information about signalment of tested cats. Most of the studied cats (191) were Domestic Short Hair (DSH), 28 Persian cats and 19 long hair cats.

Laboratory methods. The test was carried out with a commercial rapid FIV Ab test kit (Manufactured by Biotech Co., Ltd, Shanghai, Catalog No. W81042) according to the manufacturer's instructions. The kit is a chromatographic immunoassay for the qualitative detection of FIV antibody in feline serum. Immunochromatographic tests are based on immune-complex formation of antigen with antibody. All data were entered and stored in a computerized database.

Interpretation of the test. We added four drops of the serum sample into the holes using the dropper, drop by drop and slowly. As the test began to work, we saw purple color move across the result window in the center of the test device. A color band will appear in the left section of the result window to show that the test is working properly. This band is the control band. The right section of the result window indicates the test results. If another color band appears in the right section of the result window, this band is the test band. The presence of only one band within the result window indicates a negative result. The presence of two color bands (T and C) within the result window, no matter which band appears first,

indicates a positive result. Finally, test results were interpreted at 5 - 10 minutes (according to the manufacturer's instructions).

Statistical analysis. Test results and potential association with age, sex, breed, risk factors, CBC and clinical signs were performed with standard software (SPSS 15.0 for Windows, SPSS, Chicago, Illinois, USA) by Fishers exact test, Chi-square test, Independent sample t-test and Logistic regression. Values of $P \leq 0.05$ were considered to indicate a statistically significant difference.

Results

Prevalence and risk factors. Prevalence to FIV antibodies in these cats was 10.5% (25 out of 238) by ICA, indicating that this virus is present in the ecosystem. The infection had more prevalence in cats above 3 years (13.9 %; 21 out of 151) compared with cats less than 3 years (4.6 %; 4 out of 87) and odds ratio was 3.35 (95 % CI 1.11-10.11). The age of FIV-positive pet cats ranged from 1.75 to 10 years. The mean age of FIV-infected and FIV-negative cats were 4.93 ± 0.43 years (range 1.75 - 10 years) and 4.15 ± 0.20 years (range 0.4 - 15 years), respectively. Six out of 36 cases (16.7 %) which had clinical signs and 19 out of 202 cases (9.4 %) which hadn't clinical signs were seropositive, without significant difference between two groups (95 % CI for OR = 1.92). Prevalence of infection was 12.6 % (16 out of 127) in males and 8.1 % (9 out of 111) in females, nevertheless the infection was not significant between different sexes ($P > 0.05$). Leukopenia (less than 5500 cells/ml), lymphopenia and neutropenia were seen in most of the affected cats to infection (72 %; 18 of 25). The difference was significant for leukopenia ($P < 0.05$). Regression analysis confirmed several factors included older age (95 % CI for OR = 3.35), access to outdoor and contact to other cats (95 % CI for OR = 140.9) and aggressive behavior

Table 1. Prevalence of *Feline immunodeficiency virus* infection in cats with different age and sex in Ahvaz district, Iran by ICA Kits, 2007-2010.

Age	≤ 3 years		> 3 years	
	Neg.	Pos.	Neg.	Pos.
Male	38	2	73	14
Female	45	2	57	7
Total = 238	83	4	130	21

(95 % CI for OR = 82.71) that were significantly associated with risk of FIV infection. Living in a multi-cat household did not influence the risk of FIV infection. Twenty two out of 191 DSH cats and 3 out of Long hair cats were seropositive without significant difference ($P > 0.05$). Results are summarized in Table 1.

Discussion

The present study is the first report on the prevalence of *Feline immunodeficiency virus* in companion cats in Ahvaz district, South-West of Iran, using ICA kits, revealed that 10.50 % of cats were seropositive for FIV. The results indicated that FIV can be as a cause of mortality in cat's population in this area. Antibody detection against FIV is very important in cat population, because FIV is highly contagious and there are many stray cats in this area. These animals can be concerned in disease transmission to other cats, particularly companion cats. The first study on FIV in Iran was carried out by Malmasi (2002) in Tehran, Iran.¹⁸ Two out of 131 samples were positive against FIV by western blot technique. Akhtardanesh *et al.* (2010) showed 19.2 % infections in cat's population in Kerman, Iran by ICA.¹⁹

FIV is a common feline pathogen; with an overall infection prevalence of approximately 11 % in cats' worldwide.²⁰ Depending on the design, the sample population and the laboratory methodology implemented, prevalence has been found to vary considerably between studies. Some countries report few

infected cats, and others, such as Italy and Japan, with large populations of free-roaming cats have prevalence rates that can approach 30 %.²¹ Seroprevalence of FIV infection was reported 3.6 % from the Gulf Coast hurricane disaster area,²² 8.8 % in feral cats on Mauna Kea, Hawaii,²³ 5.3 % in Germany by Adler *et al.* (2007),²⁴ 8 % in the pet cat sample population in Sydney Australia,²⁵ 8.8 % of the samples tested in Costa Rica,²⁶ 0 % in Galapagos,²⁷ 11.3 % in the district of Pisa, central Italy,¹⁵ 7.4 % in Spain,²⁸ 23 % in the urban strays, 5 in the feral cat colony, and 5.9 in the client-owned cats of Ottawa,¹³ in 6 domestic and 22 feral cats in west India,²⁹ 2.3 % in North America,¹¹ 0-6 in central west Saudi Arabia,³⁰ 3.2 in Germany by Gleich *et al.* (2009),³¹ 25 % in wild Mongolian Pallas' cats³² and 4.3 among cats in Canada.³³

Cats between 4–7 years old are in increased risk.⁴ FIV was significantly higher in adult cats than in juveniles and in males than in females.²² 88.8 % of the seropositive cats were older than 1 year of age, and a greater proportion of seropositive males (66.6 %) was found.²⁶ The median age of FIV-positive pet cats (11 years) was significantly greater than the median age of FIV-negative pet cats. Median age was 6 years for FIV in Germany. Risk factors for FIV infection were male gender, older age, mixed breed, access to outdoor, aggressive behavior, and FeLV co-infection.³¹ Cats with higher age have more contact with infected animals. Male cats are affected to FIV more than females due to more contention

between males, but our studies could not demonstrate a correlation between gender and disease. These results were similar to work of Levy *et al.* (2006)¹¹, however in contrast to Gleich *et al.* (2009) in Germany.³¹

In stray cat's population, both sexes are similarly exhibiting the infection, although male cats were at higher risk for FIV as reported by Luria *et al.* (2004).³⁴ Our study showed that the seroprevalence of infection was more in cats above 3 years (13.9 %) compared with cats less than 3 years (4.6 %), and the difference was significant by statistical analysis ($P < 0.05$). Cats may sero-convert in as short as 3 weeks or as long as 10 months after becoming infected with FIV. Also, care must be taken when interpreting test results in kittens less than four months of age as maternal FIV antibodies may be present. So cats selected in our study were above 1 year.

As ten out of 14 ill cats had leucopenia, it seemed that leukopenia was an important paraclinical feature in cats suspicious of FIV. Complete blood count is useful, particularly in concurrent infections. Hematological abnormalities were detected in 48 % of FIV-infected asymptomatic cats in which no other cause of cytopenia than FIV infection was observed. Anemia only, neutropenia only, thrombocytopenia only, bicytopenia and pancytopenia were observed in 10 %, 10 %, 6 %, 14 % and 8 %, respectively by Fujino *et al.* (2009).³⁵ leukopenia (less than 5500 cells/ml), lymphopenia and neutropenia were seen in most of the affected cats to infection (72 %).

Infection with opportunistic pathogens of viral, bacterial, protozoal, and fungal origin have been reported in FIV-infected cats.^{4,36-40} In a report by Dubey *et al.* (2009), there was no correlation among *Toxoplasma gondii*, *Bartonella spp.*, and FIV seropositivity.²⁹ Infection with either FeLV or FIV was associated with an increased risk for coinfection with the

other retrovirus, *M. haemofelis*, or *M. haemominutum*.³⁴

Our data indicated that chronically infected carriers without clinical symptoms were frequent in the investigated cat population. Among the FIV positive cats, 16.7 % of the cats with clinical signs were seropositive, whereas 9.4 % of the cats without clinical signs were seropositive for FIV. These findings show that clinical signs are not significant for definitive diagnosis of FIV. In conclusion, we emphasize that prevention of contact with stray cats could be an important measure in the control of FIV infections to companion cats. Unfortunately, vaccination against FIV is not present in Iran and many countries. Whether vaccination will reduce or increase the incidence of infection in the cat population at large is unknown.²⁰ Further epidemiological and biological surveillance are needed to control the disease in stray and domestic cats.

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